

COMPUTERWORLD

\$2.00 A COPY; \$44/YEAR

AUGUST 5, 1985

VOL. XIX, NO. 31

Slumping mini firms act to calm users

By Clinton Wilder
CW Staff

Fourteen months ago, the Henley Paper Co. in Greensboro, N.C., decided that Wang Laboratories, Inc. would be its main computer vendor. The firm committed to purchasing a Wang VS 100, with plans for a future VS 300 upgrade, a VS 65, four VS 15s and 75 workstations. "We are dependent on Wang in the near term and the long term," DP administrator Ray Anderson said. "We're very dependent on [its] future."

But Wang's future has become clouded in recent months. Although companies from IBM on down have announced lower earnings or losses, the losses and layoffs at Wang and Data General Corp., coming after years of virtually uninterrupted and spectacular success, have been particularly shocking. Both companies are currently in transition as they seek to reverse recent setbacks, and users, analysts and company executives are watching anxiously to see if they will succeed.

"I have a concern about it," Anderson said of continued customer service from Wang, "but it's the same with the industry. Wang's not unique. I'd feel more secure in an IBM environment, just because

[IBM is] so large, but I still look first at what applications software is out there. If software led me to IBM, great, but if not, I'd still pick the other vendor, like we did with Wang. And I think [Wang is] definitely trying harder now."

Both Wang and DG have redefined their goals this year in the highly competitive office automation market, but the changes at Wang have been more fundamental and structural. The Lowell, Mass.-based Wang has eliminated a layer of middle management and has centralized its marketing approach, attempting to shed its word processing mantle for full-scale DP pitches to MIS managers.

"With our rapid growth, a lot of layers were put on top of things," said Thomas Mercer, Wang's director of product marketing. "Each [regional] branch developed its own marketing program. Now all of that is coordinated at Lowell. Branch managers are asked to come to Lowell on a quarterly basis, at a minimum."

Burned by late deliveries of the six products it announced in October 1983, Wang has vowed to restore its credibility. "Our idea is to do less but to do it better," said John Thibault, vice-president of product planning and management. "We've

See **DOWN** page 8

Both Wang Laboratories, Inc. and Data General Corp. made additions to their micro lineups last week:

■ Wang unveiled its next-generation Advanced Professional Computer and products designed to link IBM Personal Computers to Wang's VS minis. Page 6.

■ DG took the wraps off the Dasher/One, an IBM-compatible personal computer; enhanced its MV/4000 DC supermini-computer; and announced the MS-DOS-based CEOWrite program. Page 6.



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Finding fortunes

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Ashton-Tate in micro merger

By Maura McEnaney
CW Staff

CULVER CITY, Calif. — Intense acquisition activity within the young microcomputer software industry continued last week when data base management leader Ashton-Tate announced its intent to acquire word processing champion Multimate International Corp. for \$19 million in stock and cash.

The acquisition, Ashton-Tate's second this year, not only will add the leading independent word processing package, the Multimate Professional Word Processor, to its lineup of data base and integrated software products but also will provide Ashton-Tate with broader reach into the large

corporation market, where Multimate has a strong presence.

"We're trying to move Ashton-Tate from a microcomputer software company to a computer services company," Ashton-Tate President Edward Esber told *Computerworld* last week. "This clearly establishes us as a dominant supplier in the data base arena and the word processing arena."

Earlier this year, Ashton-Tate had acquired Forefront Software Corp. of Sunnyvale, Calif., author of the popular Framework program, which Ashton-Tate had been distributing. In other merger activity so far in 1985, Lotus Development Corp.

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TOP OF THE NEWS

Datapoint moved fully into the videoconferencing arena with an IBM-compatible, full-motion video workstation. Page 4.

■ Drawing a parallel line, PE unveiled a mid-range supermini that can be expanded into a six-processor system. Page 9.

■ Winnebago Industries' chairman is pushing his company and Forest City, Iowa, into the information vanguard. Page 10.

■ Intel shipped its first five Intel Personal Super Computer hyper-cube systems to researcher customers. Page 53.

FYI

Electronic transfer: Computer pro rises at Chase

By Charles Babcock
CW New York Bureau

Arthur F. Ryan said he thinks extending bank services to consumers goes hand in hand with technology, and that is one reason he has been plucked from the ranks of data processing to head consumer banking operations at New York's Chase Manhattan Bank NA.

Named executive vice-president last November, Ryan, 42, brought an expertise in computers to what the bank said it hopes will be an expanding sector of its business.

"Banks are looking for more and more people schooled in the computer industry," said Thaddeus W. Paluszek, a bank-

ing industry analyst with Merrill Lynch, Pierce, Fenner and Smith, Inc. in New York.

Computers have become central to the banking business because of their ability to process large volumes of transactions. Instead of treating computers as a utility, however, banks are beginning to see them as crucial to their business planning and strategies. A banking service can be provided quickly if the underlying computer service is already in place, pointed out Big Eight accounting firm spokesmen familiar with the banking industry.

In addition, microcomputers are beginning to help banks sell products to customers through the use of financial

analysis and asset management tools, said Jan H. Linker, vice-president of the Electronic Banking, Inc. division of Bank Earnings International in Atlanta.

The promotion of DP executives into general management "is an acknowledgment by senior management that these people possess the skills needed to utilize this resource," said a Coopers & Lybrand manager in New York.

The most visible promotion of an executive skilled in computer technology was the appointment in September of John S. Reed as chairman of Citicorp, the nation's biggest bank.

Reed, however, graduated from MIT in Cambridge, Mass., with the equivalent of

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NEWSPAPER

NEWS

Computer Inquiry III opens

WASHINGTON, D.C. — The Federal Communications Commission has proposed relaxing the major regulatory barrier that prevents the regional holding companies and AT&T from mixing computer processing services with their underlying basic telecommunications transmission.

The FCC recently opened its Third Computer Inquiry, five years after establishing its Second Computer Inquiry decision that required the former Bell operating companies and AT&T to set up separate subsidiaries if they wanted to sell enhanced computer communications products such as packet switching, voice store and forward and customer-controlled switching.

The FCC proposal, which will be open for public comment, puts forth the use of a new standard of assessing the state of competition in a given service offering instead of defining a standard of what is computer enhanced and what is not.

"We want to come up with a mechanism that encourages and does not impede growth of new services," said Albert Halprin, FCC Common Carrier Bureau chief.

The FCC said that since the divestiture of AT&T into the seven regional holding companies and AT&T, a rash of waiver requests from the separate subsidiary restrictions outlined in Computer Decision II has pushed the FCC into a role of defining what types of services could be permitted, a role Halprin said the FCC should not take on.

The result was "horribly inefficient" for ser-

vices being introduced into the basic telecommunications network. The FCC said it will permit new services as long as several necessary conditions are met. The conditions include whether the service is being offered by a carrier or vendor that has control over the bottleneck local-loop facilities or long-distance network in an exchange area; whether there are other providers of similar services; and whether new players can freely enter the market.

The FCC's plan proposes retaining regulation if a carrier does maintain monopoly control over facilities and wants to offer a computer enhancement through the network. However, the policy would drop the requirement that the service be marketed through a separate subsidiary, such as AT&T Information Systems in the case of AT&T.

Instead, FCC regulation would consist of requiring the service to buy the basic transmission portion of the offering at the same rates and terms other vendors would pay for equivalent service. Additionally, the FCC would require separate accounting procedures for the enhanced service.

There are four possible new service categories affected by the proposed regulations, the FCC said. These include protocol conversion; the interconnection or co-location of a vendor's equipment at the local exchange switch owned by the carrier or another vendor to provide integrated digital services; voice message storage services; and network channel terminating equipment.

CORRECTIONS

It was reported that Fortune Systems Corp. was operating under reorganization protection [CW, July 8]. That statement was incorrect. Fortune Systems' most recent financial statement, released July 23, reported second-quarter revenue of \$14.6 million and profits of \$222,000.

A product announcement for Intrak, Inc.'s compiler for NCR Corp.'s V series mainframes [CW, June 10] incorrectly listed the company address. Intrak is located at 9999 Business Park Ave., San Diego, Calif. 92131.

The price for Marcam Data Systems Corp.'s Pivot RPG-III order processing, invoicing and sales analysis system for the IBM System/38 was incorrectly listed [CW, June 24]. The package is priced at \$14,200.

The photographs for the In Depth story "Growing up with MS-DOS" [CW, July 22] were incorrectly credited to the author; they should have been credited to David Current.

It won't cost a dime

Hard as we try to give our readers the most complete information available, some good news and feature stories never reach us.

Are you involved in an unusual application of DP technology in your company? Have you implemented successful cost-cutting strategies? Is something in your DP shop not working as designed? Heard any hot news about vendors?

If so, we'd like to hear from you. Computerworld has established a reader hot line for information regarding items of interest to the computing community. Call us toll free at (800) 343-6474. Ask for Donovan White, assistant managing editor.

We can't be everywhere — but our readers are.

NEWS SUMMARY

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PE launched a mid-range superminicomputer that can be extended into a six-processor parallel system/9

A change in leadership has Winnebago Industries traveling down the road to automation/10

Judge Harold Greene has clarified the ability of former Bell operating companies to provide private switched services that can be configured to cross exchange boundaries/12

CW at Directions '85: The DP manager is like a long-

distance runner who must avoid pitfalls while carrying the millstone of old systems and methods, according to a Cincom Systems product manager... MIS managers should take a four-pronged approach to building an integrated applications portfolio/13-15

The U.S. Federal Aviation Administration awarded a \$432 million contract to IBM for air-traffic control computers/16

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Random access

At its annual user conference in Boston later this month, McCormack & Dodge will introduce an enhanced version of its Millenium on-line processing environment, which serves as a base for its line of application software. The company also plans to introduce a long-awaited accounts receivable package.

Global Ultimate Systems, Inc. last week officially severed its ties with financially troubled STC. STC's internal credit committee approved a plan whereby Global employees will buy the company from STC, a move which a Global Ultimate spokesman said would allow the company to seek credit to finance future ventures. Global Ultimate is what remains of now-defunct Magnuson Computer, Inc.

DEC's push into the office will be furthered by an announcement of software for the Microvax II that will allow file transfer with IBM's Distributed Office Support System (Dioss), predicts George Colony of Forrester Research, Inc., of Cambridge, Mass. DEC recently announced External Document Exchange for the VAX/11/725 to the VAX 8600 [CW, July 15]. The software allows a Decnet network user to read but not revise Dioss documents.

The departure of John Cunningham from the positions of president and chief operating officer at Wang came after months of company denials that the departure was imminent. A top spokesman several weeks ago said he wished he could put a stop to the stories. Straining the credibility of any Wang official statement is Cunningham's confirmation that he had been considering jumping ship for several months. What should we now make of the official line denying the persistent rumors that Wang is scheduling a second, possibly bigger, round of layoffs for late summer?

For the unveiling today of its 3230XP and 3230MPS parallel processing models, PE called on members of the press a few days early to provide an embargoed early look. However, for a mysterious announcement scheduled for next month, the company plans a New York harbor cruise extravaganza. Officials would only say the company is intent on delivering a full line of parallel processing equipment. If the 3230 models unveiled today rate only an office visit, then a harbor cruise presumably will involve something much bigger.

U.S. District Judge Harold Greene is getting tired of reviewing what he calls "voluminous and in some cases superfluous briefs" filed by parties in the petitions to waive terms of the AT&T divestiture. Greene last week scheduled one of his rare oral sessions, to be held Aug. 9, to discuss the merits of cellular radio voice storage and retrieval for cellular and shared telecommunications services. Is this perhaps revenge on those planning August vacations?

Osborne Computer Corp. is living proof of information's strategic importance for large organizations. In its heyday, the manufacturer of portable microcomputers dedicated 90 members of its work force to user support, according to company President Ron Brown. After declaring bankruptcy and filing for protection under Chapter 11 of the Federal Bankruptcy Act, the company's internal user support section was reduced in size. Because the firm had kept electronic records of its entire customer base, it was able to eliminate all but two employees in the department at a time when it desperately needed to minimize overhead, Brown said.

WHO DUNIT

Sortland Yard warns against "Raffles-type sort programs."

Call (201) 568-9700.

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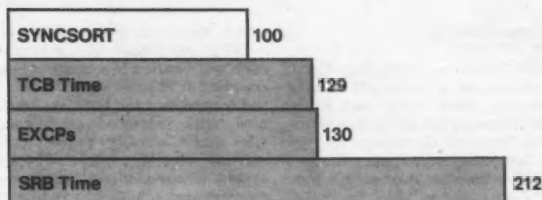
In an extraordinary move, Sortland Yard today warned data processors throughout the world to be on guard against what it termed "gentleman-bandit sort programs."

The warning was issued by one of the Yard's best known figures, Inspector SyncSort, who has sometimes been called "a legend in his own CPU time."

The inspector said, "One of the difficulties in apprehending these chaps is that they look so eminently respectable. They're members of a fine old hardware family. They've been to the right schools. And they invariably carry out their burglaries while wearing a dinner jacket from Saville Row."

EXPERT COMPUTER CRACKERS. "But once the party is underway," the inspector said, "these chaps head straight for the place where the family jewels are kept. They can crack open a computer and make off with a king's ransom in computer resources before you can say 'Hound of the Baskervilles!'"

To indicate "the true cost of this sort of misbehavior," the inspector released the following crime statistics:



DFSORT, Release 7.0

SOMETIMES TAKE HOSTAGES. The inspector noted that these black-sheep programs often "take a dreadful toll" of programmers. "They are often tied up for days on end and forced to perform unnecessary coding, compiling and debugging. And they are heartlessly deprived of the labor-saving features that are taken for granted in most parts of the civilized sorting world."

Among these the inspector listed:

- SORTWRITER
- MULTIPLE OUTPUT
- RECORD EDITING
- FAST FILE COPY
- MAXSORT

TELEPHONE BEST DEFENSE. The inspector urged data processors to call the Yard immediately if they suspect their center is infested by a Raffles-type sort program. "The number is (201) 568-9700. We'll send over one of our highly trained sort detectives to track the culprit down."

Questioned as to what would be done with sort programs caught burglarizing computer centers, the inspector replied. "They will be given a just and speedy trial. If found guilty, they will immediately be transported to Iran!"

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INC.

Syncsort Incorporated 560 Sylvan Ave., Englewood Cliffs, N.J. 07632

NEWS

DEC ports All-In-One software to 32-bit Microvax II

By John Desmond
CW Staff

MERRIMACK, N.H. — Furthering its push into the office automation competition, Digital Equipment Corp. last week announced that its All-In-One Office and Information System software is now available for the 32-bit Microvax II supermicrocomputer.

All-In-One on the Microvax is said to offer the same functions that are available on the VAX. The Microvax All-In-One includes WPS-Plus for word processing, All-In-One Mail, Time Management, Desk Management, Information Management, Help functions and computer-based instruction and costs \$12,600. Customers need the All-In-One Generator Package running on the VAX-11/750 or larger systems to customize the Microvax II software, according to the vendor.

DEC also acknowledged the widespread presence of the IBM Personal Computer in the office by announcing various software packages that allow the IBM micro to communicate with the Microvax II and VAX systems.

'A way to fight back'

The All-In-One announcement "is important because IBM is attacking at the low end of the office market with the System/36, and DEC needed a way to fight back at that level of machine," in the view of George Colony, president of Forrester Research, Inc. in Cambridge, Mass.

The move also gives DEC users a low-end entry

into All-In-One, previously available only on a more expensive VAX supermicrocomputer. "Large users can now get a taste of All-In-One as a sort of pilot system," Colony said. "It was such an all-or-nothing type sale in the past."

Gene Hodges, manager of market development in DEC's Office Information Systems Division, pointed to the ability to build distributed systems with the Microvax II All-In-One software, which is compatible up the line of VAX hardware.

Colony said, "In the distributed office systems environment, [the new software] is a perfect link with the larger All-In-One" running on other VAXs.

Decnet-DOS for Microvax II

The DEC announcements also included Decnet-DOS for the Microvax II, a \$500 package that allows IBM Personal Computers to participate as end nodes in Decnet networks based on the Microvax II and other VAXs.

Among other introductions, DEC announced software permitting IBM Personal Computers and compatibles to emulate DEC terminals to the Microvax II. Vterm II software allows the IBM Personal Computer to emulate a DEC VT100 terminal, for file transfer from the IBM micro to a Microvax II or VAX system. Vterm II is priced at \$160.

PolyCom 220 and 240 emulation packages, developed by Polygon Associates, Inc., allow IBM Personal Computers to emulate DEC VT200 terminals to VAX systems. The packages cost \$200 and

\$300, respectively.

Colony called the price of linking the IBM Personal Computer to the Microvax II a possible stumbling block, saying it may be less expensive for users to use DEC terminal emulation software from independent vendors.

Runs with 5M bytes of memory

All-In-One software runs under the MicroVMS operating system on the Microvax II with a minimum of 5M bytes of memory. The All-In-One Generator Package costs \$5,500. Runtime licenses for customized packages cost \$12,600 for each Microvax II system.

The cost for a Microvax II system with 16 active users and 30 subscribers, 9M bytes of memory, Decnet, Xerox Corp. Ethernet and terminal services, 30 VT220 terminals and All-In-One software that offers word processing, electronic mail, time management and administrative support, costs slightly more than \$120,000 — approximately \$4,000 for each subscriber.

DEC announced that the A-to-Z Integrated Software development package is also available on the Microvax II. A-to-Z integrates graphics, word processing and spreadsheets with customized business applications. Software modules of A-to-Z on the Microvax II cost \$1,395 for word processing, data management and business graphics. The A-to-Z Base System costs \$1,295. The A-to-Z Integration Kit costs \$1,395.

DEC is located in Maynard, Mass. 01754.

Datapoint unveils color, full-motion video unit

By Charles Babcock
CW New York Bureau

NEW YORK — Datapoint Corp. has announced a workstation with full-motion, color video and voice communications for use on a network of IBM Personal Computers or Personal Computer-compatible units.

The Multimedia Information Network Exchange, or Minx, workstation consists of a high-resolution color monitor, a color motion picture camera, a viewfinder and a full-duplex speakerphone and is plugged into the Personal Computer, taking the place of the Personal Computer monitor. It allows videoconferencing among any number of users on the network, company officials said. The video portion of the conference is voice activated, with each user's screen showing whoever is speaking, company officials said.

Although Datapoint officials said the system can be geared for use with any personal computer, it has been implemented only for IBM Personal Computers and compatibles so far. It may be used with Datapoint's Vista-PC, an IBM Personal Computer-compatible, including an Intel Corp. 80186 microprocessor.

George L. Leonard, director of marketing for Datapoint's Advanced Products Division, the new unit that developed the Minx, said 8-bit microprocessors in the Zilog, Inc. Z80 family run the workstation and cluster servers that manage communications between up to eight workstations and the rest of a network.

In a basic eight-workstation cluster, each workstation is priced at \$9,990, plus \$9,200 for the cluster server. In addition, a \$400 keypad is needed for dialing on the system and a \$495 interface cable connects the

unit to the Personal Computer.

When purchased with a Vista-PC, each workstation in a cluster of eight is priced at \$14,395.

Leonard said the Minx is available now, with shipments to customers who have already placed orders starting later this month. The Minx system is intended for use on local-area networks, including Datapoint's Arcnet local-area net, and larger networks, company officials said.

Eight workstations can be connected to a cluster server through a single coaxial cable; the maximum distance between server and workstation is 1,000 feet. Larger networks of more than 200 users and 32 cluster servers can be built with industry standard, broadband networks, company officials said.

Workstations on Datapoint's baseband Arcnet can be connected to a more extensive broadband network through modem gateways that convert baseband signals to broadband, Leonard said.

The Minx workstation may also be used without being connected to a personal computer for voice and video communications, but it then loses the capacity for data communications, company officials said.

In addition to the normal configuration, standard video equipment may be attached to the workstation and used with it — video cameras, video recorders, monochrome document cameras or closed circuit video sources, such as news or business programming, company officials said. For private conversations, a telephone handset may be attached, the officials added.

Datapoint is located at 9725 Datapoint Drive, San Antonio, Texas 78284.

Looking for live stories on terminal technologies

New technologies have dramatically changed traditional data communications terminals. Now display and graphics terminals are available for the corporate and DP environment that feature a wide and impressive range of capabilities.

The *Computerworld* October Special Report on data communications terminals will examine some of these new terminal technologies, specifically high-resolution color graphics terminals and terminals with integrated voice/data telecommunications options.

The Oct. 28 report will also address the pros and cons of terminal communications as opposed to microcomputer communications from a data processing perspective.

Article contributions are now be-

ing considered for publication in the report. Submissions should take one of two forms:

■ A tutorial article discussing an issue or a trend.

■ An application story outlining a particular user's experience with data communications terminals.

The deadline for contributions is Aug. 30.

Articles must be typed, double-spaced and range in length from three to five pages. Artwork such as charts, graphs and photos is encouraged.

If you have a story you would like to tell or an opinion you would like to express, contact Janet Fiderio, Special Reports Editor, *Computerworld*, 375 Cochituate Road, Box 880, Framingham, MA 01701.

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Computerworld (ISSN-0010-4841) is published weekly, except: January (5 issues), February (5 issues), March (5 issues), April (6 issues), May (5 issues), June (5 issues), August (5 issues), September (6 issues), October (5 issues), November (5 issues) and a single combined issue for the last week in December and the first week in January by CW Communications, Inc., 375 Cochituate Road, Box 880, Framingham, Mass. 01701.

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NEWS

Wang offers 80286-based micro

By Eric Bender
CW Staff

LOWELL, Mass. — Wang Laboratories, Inc. took conflicting steps in its cautious dance toward the IBM Personal Computer standard last week, as it launched a non-IBM-compatible Advanced Professional Computer along with three products linking the IBM micro with Wang VS minis.

The Advanced Professional Computer is completely compatible with the company's Professional Computer, permitting users to upgrade to the new design by swapping system boards, and it runs comparable software up to twice as fast as the IBM Personal Computer AT, Wang officials claimed.

However, industry analysts generally registered surprise that Wang did not make the system compatible with the AT. "I don't understand why they're still resisting the full IBM-compatibility issue," commented Tom Billadeau, president of TRB & Associates, Inc. in Ogunquit, Maine.

Available now at a starting price of \$3,465, which does not include a monitor, the machine is built around an 8-MHz Intel Corp. 80286 chip and features 512K bytes of internal memory, which is expandable to 2M bytes on the system board.

The system acts as a single-user workstation under Microsoft Corp.'s MS-DOS 2.11 or supports up to four users under Microsoft's Xenix. More than 600 MS-DOS applications are available, and an emulation option allows about 90% of IBM microcomputer applications to run, the company said.

Last week's introductions also included Wang Word Processing for the IBM Personal Computer, the Wang Local Office Connection and the Wang Remote Office Connection, all said to work with the Personal Computer and Personal Computer XT but

not with the AT.

The word processing package includes the company's widely used software, a replacement keyboard that handles both Wang and IBM functions and an interactive tutorial. Priced at \$695, the package is scheduled for October shipment.

Wang's Local Office Connection enables the IBM micro to act as a VS workstation, giving access to host resources such as printers, storage devices, communications options and Wang Office and other system applications. All VS terminal functions are supported except graphics display on the IBM monitor, the company said. The product consists of an emulation card, a coaxial link to the host, word processing software and a replacement keyboard. The Local Office Connection costs \$1,895, and delivery is expected in December.

The Remote Office Connection combines a word processing package and keyboard with a Wang Systems Network component originally announced in June 1984 and never shipped.

The connection permits Personal Computer users to hook up to a Wang VS minicomputer over point-to-point or multipoint synchronous links at speeds up to 9.6K bit/sec. and to run VS applications, Wang said. The product also allows users to transmit or retrieve for editing word processing documents to and from the VS and to store binary files on the larger system. The Remote Office Connection costs \$1,200 and is slated for October availability.

The standard Advanced Professional Computer comes with a five-slot chassis, serial and parallel ports, keyboard and a single 360K-byte floppy disk drive. Another version with an eight-slot chassis and a 1.2M-byte floppy disk drive is priced at \$3,900. A system upgrade from the Professional Computer costs \$2,000.

Among other options are a Character/Graphics/IBM Emulation (CGI) card that combines IBM monochrome character, Wang monochrome graphics and IBM monochrome emulation and keyboard control for \$655; a \$1,000 20M-byte, half-height hard disk drive and a \$4,400 67M-byte full-height hard disk drive, each requiring a \$595 controller; a 43M-byte

See WANG page 8

DG unveils IBM-like desktop

By Edward Warner
CW Staff

WESTBORO, Mass. — In an effort to capitalize on the escalating trend that sees users linking office personal computers with departmental minicomputers, Data General Corp. has introduced its first IBM-compatible desktop personal computer. At the same time, DG doubled the number of users supported by its Eclipse MV/4000 DC minicomputer.

To take the computing-intensive task of word processing off the MV/4000, DG capped the rollout with the introduction of CEOWrite, a Micro-Soft Corp. MS-DOS-based word processing program. DG said CEOWrite will integrate with DG's CEO office automation software to permit document sharing via the MV/4000 DC. With word processing taking place off-line, the MV/4000 DC will be considerably faster, the company added.

The star of last week's rollout, however, was the Dasher/One, a 256K-byte personal computer offered in two models, each with a 12-in. green-screen monitor and at least one 3½-in., 720K-byte diskette drive. The machines will be directly marketed both to new customers and to DG's installed base of minicomputer users, according to Lou Delzompo, DG senior product manager for workstations and communications.

The Dasher/One is not a complete clone of the IBM Personal Computer, however. For one thing, it uses 3½-in. diskette drives, rather than the Personal Computer's 5¼-in. drives. Delzompo said the Dasher/One has 3½-in. drives because that is the size of the drives in DG's first IBM-compatible personal computer, the laptop portable DG/One, introduced last fall.

He also noted another incompatibility with the Personal Computer: The Dasher/One will not accommodate Personal Computer-compatible

option boards. DG will introduce its own line of option boards for the machine, Delzompo said.

Delzompo said DG waited until now to introduce an IBM-compatible desktop because there "wasn't a clear user demand from our customers." It was also not until recently that decreases in hardware costs permitted the creation of an IBM-compatible priced similarly to an intelligent terminal, he added.

Pricing concerns, he said, were also behind the use of the Intel Corp. 8088 microprocessor in the Dasher/One. Nearly all of the latest personal computers for the office, including the Wang Laboratories, Inc. Advanced Professional Computer (see story at left), use the Intel 80286 chip, the high-speed processor used in the IBM Personal Computer AT.

Users access CEO features

Using DG's CEO Connection software — introduced in February for the DG/One — the Dasher/One, the DG/One and the IBM Personal Computer reportedly can operate as MV/4000 DC workstations, accessing CEO software. As a result, DG said, workstation users can access such CEO features as electronic mail and filing, calendaring, word processing and decision support. CEO Connection costs \$295 for the Dasher/One and DG/One and \$395 for the Personal Computer. A version for machines under DG's AOS/VS operating system costs from \$1,600 to \$3,250, depending on the CPU.

The \$2,100 Dasher/One Model 1, based on the Intel 8088 microprocessor, reportedly runs all IBM Personal Computer software at the IBM machine's standard 4-MHz clock speed. The \$2,415 Dasher/One Model 2, based on the Intel 8088-2 chip, offers users a switch-selectable chip speed of either 4 MHz or 8 MHz, a second 3½-in., 720K-byte diskette drive and screen resolution of either 200 by 600 pixels or 400 by 600 pixels, the latter for use with text.

Users may, at no extra cost, choose either of two keyboards, one similar to that of the IBM Personal Computer AT and the other designed specifically for use with the CEO software, DG said. Options for both models include a 10M-byte internal hard disk, a sec-

See DG page 8

Wang, DG debuts draw little enthusiasm from analysts

By Edward Warner
and Eric Bender
CW Staff

Most analysts reacted with relatively little excitement to Wang Laboratories, Inc.'s and Data General Corp.'s announcements of personal computers and software last week.

Indicative of the responses were the comments of Kenneth Bosomworth, president of International Resource Development, Inc., a Norwalk, Conn., market research firm. "There's no suggestion that these companies have any new ideas to bring to the market," Bosomworth said. "It [looks] more like a lack of strategy — like lemmings [jumping] into the ocean, just falling over each other."

Tom Billadeau, president of TRB & Associates, Inc., a research firm in Ogunquit, Maine, expressed disappointment that Wang did not become the first major computer vendor to introduce an AT-compatible machine.

Bosomworth also downplayed the importance of the new Wang system. "I would be really hard pressed," Bosomworth commented, "to see a rea-

son to buy that machine over the AT."

Having unveiled a desktop machine that is not compatible with the latest IBM offering, Wang is still bucking the Big Blue trend, said George Weiss, president of Quantum Science Corp. in New York. "Our research shows that workstation procure-

ANALYSIS

ment in large organizations is almost exclusively IBM or IBM-compatible products," according to Weiss. "It's a difficult time for Wang, DG and [Digital Equipment Corp.] to make inroads in the workstation marketplace."

DG's introduction — an IBM-compatible personal computer that can operate as a workstation with the DG MV/4000 DC minicomputer — received a favorable reaction from analyst George Colony. According to Colony, president of Forrester Research, Inc. in Cambridge, Mass., DG was "giving users the alternative of attaching to CEO [DG's office automation software] on the MV/4000 via a terminal or attaching a personal computer to that departmental system and getting some resource distribution."

On the software side, analysts reacted more pos-

itively. Of the debut of DG's CEOWrite for off-line word processing on either the Dasher/One or IBM Personal Computer, Colony said that taking word processing off the MV/4000 means that users "are going to get better performance out of CEO [software]."

Billadeau, too, liked the idea of CEOWrite, which he said was important for its ability to span a wide range of DG systems. He also said he liked the choice of three user interfaces for the word processor. "You can turn on menus ad nauseum, or go way down to the control level."

Wang's enhanced communications offerings also received good reviews, although analysts noted some limitations of the products.

Wang's workstation strategy "enables us to welcome wholeheartedly the IBM Personal Computer into the Wang fold and opens the VS family to IBM Personal Computer users," said J. Carl Masli, senior vice-president for worldwide sales and marketing, at last week's announcement.

But such fine sentiments have not yet made the IBM Personal Computer a true family member, Billadeau said. "It's clearly a stepchild."

ORACLE

The portable version of IBM's DB2 and SQL/DS

COMPATIBILITY

The ORACLE relational database management system is fully compatible with IBM's SQL/DS and DB2. SQL/DS and DB2 represent IBM's latest generation of database management technology for IBM's largest computers. ORACLE's capabilities and user interface - the SQL language - are identical to those of SQL/DS and DB2. Programs written for SQL/DS and DB2 will run unmodified on ORACLE.

PORTABILITY

SQL/DS and DB2 run only on IBM mainframes; ORACLE runs on IBM mainframes, DEC, DG, AT&T, HP, STRATUS, and several other manufacturers' minicomputers, and on a wide range of microcomputers including the IBM PC/XT and PC/AT. All versions of ORACLE are identical and include a complete implementation of SQL - not a subset.

CONNECTABILITY

Having the same software running on your mainframe, minis, and micros greatly simplifies the task of connecting your machines into a network. ORACLE's network software allows microcomputer users to directly access data stored in the shared database on the mainframe or minicomputer, or copy that data into the database on their micros and operate independently.

Oracle introduced the first relational DBMS and the first implementation of SQL back in 1979. Today, eight of the ten largest U.S. companies use ORACLE. In fact, INC MAGAZINE ranks Oracle as the fastest-growing software company in the USA. Surprised? Don't be. ORACLE is the number one relational DBMS, with thousands of installations on IBM mainframes, DEC, DG, AT&T, HP, STRATUS and most other vendors' minis and micros. Even the IBM PC.

To attend the next free, half-day seminar in your area or receive additional information, write Oracle Corp., Dept. C4, 2710 Sand Hill Rd., Menlo Park, CA 94025, or call 415/854-7350. Following is the ORACLE seminar schedule:

ORACLE Seminar Schedule

Albany	Sept 19	Greensboro	Aug 1	Philadelphia	Jul 18, Sept 18
Albuquerque	Sept 19	Houston	Jul 30, Aug 28, Sept 24	Phoenix	Aug 6
Anchorage	Aug 29	Huntsville	Jul 31	Portland	Aug 6
Atlanta	Jul 25, Sept 18	Indianapolis	Sept 17	Rochester	Jul 23
Austin	Aug 6	Kansas City	Sept 12	Sacramento	Aug 8
Boise	Jul 30	Los Angeles	Jul 25, Aug 27, Sept 26	St. Louis	Aug 8
Boston	Jul 16, Aug 14, Sept 17	Minneapolis	Aug 1	Salt Lake City	Jul 16, Sept 24
Chicago	Jul 17, Sept 19	New Orleans	Aug 13	San Diego	Sept 10
Cincinnati	Sept 10	New York City	Jul 31, Aug 14, 28, Sept 11, 26	San Francisco	Aug 1, Sept 5
Cleveland	Aug 6	Newport Beach	Aug 14, Sept 17	San Jose	July 25, Aug 15, Sept 26
Dallas	Jul 16, Aug 8, Sept 11	Oklahoma City	Sept 17	Tulsa	Aug 15
Denver	Jul 18, Aug 13, Sept 19	Omaha	Aug 7	Washington	Jul 25, Aug 8, Sept 12, 26
Detroit	Jul 23, Aug 20, Sept 24	Orlando	Jul 17		

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NEWS

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asked ourselves, 'Do we really need so many versions, colors and variations?' [The slump] has given us a chance to clean up our product lines and focus on what's really important. It's time to put the [late delivery] ghost to rest."

Most users and third-party representatives interviewed recently praised Wang's new approach. "They're being more realistic about what products they intend to ship and when they intend to ship them, which I think is great," said David Cort of Pacific Edge Systems, a Los Angeles consulting firm specializing in Wang software. "I think it relates directly to their bad press and financial pressures."

The fiscal pressure has been brutal: Wang reported a \$109 million loss in the quarter ended June 30, swallowing a \$137 million inventory writedown and costs related to 1,600 layoffs. At a company that had come to expect 30% to 40% growth as the norm, the fiscal 1985 balance sheet saw revenue climb a mere 8% to \$2.35 billion and profits tumble from \$210.2 million in the prior year to \$15.5 million.

In nearby Westboro, Mass., DG's most recent

quarter was not much brighter. The company posted an \$8.3 million loss and a 6% decline in sales. DG's cost-cutting program included the release of 1,400 employees.

'Shakes up users'

"Of course, that shakes up users," said Peter Lowber, a minicomputer industry analyst with the Boston-based Yankee Group. "But these are big organizations; they still have more money for [research and development] than startups. It's a question of not scattering it around. They're not going to suddenly evaporate, but they have to rethink things and choose their targets carefully."

DG, taking a financial beating in its scientific/technical and small business OEM sales, has now invested heavily in targeting Wang's traditional OA market. But where Wang approached the office through the desktop word processor, DG came in from the back room housing the supermini CPU.

"[OA] has really become a system product," said Robert Miller, senior vice-president of DG's Business Group. "With us and [Digital Equipment Corp.], that plays to our strength. But we have an uphill fight to demonstrate that our product is a superior solution. We have to convince the end users

of the IBM tradition that we can support them and not just OEMs."

Miller, like Wang officials, insisted that DG's fiscal losses have not cut the meat out of R&D, only the fat. "There are some things on our 'we'd like to do' list that we're not going to get to," he said, "but we've been careful to have no drain on R&D in critical areas like [OA]. Our cost cuts have lightened the boat, but we don't want to do anything to the engine that runs it."

Miller admitted that customers may feel IBM is the safest port in the industry storm but contended that DG's recent news has not shaken its own reputation. Except for consolidating the formerly separate dealer sales unit into its North American sales division, DG has not reacted to the downturn with major organizational changes, Miller said.

"We're basically batten down the hatches and riding it through," he said. "Even though the layoffs look the same [as Wang's situation], the stability of our management speaks for itself."

Richard Swan, DP manager of the DG-based shop at L. S. Starrett Co. in Athol, Mass., said he has not seen any changes. "Our salesman was a victim [of layoffs], but we seem to have a very capable replacement," he said.

WANG from page 6

streaming cartridge tape drive for \$2,500; a 512K-byte, user-installable memory upgrade for \$580; and an Intel Corp. 80287 numeric coprocessor priced at \$375.

Xenix System III will be offered next month for \$995. Multiuser configurations require use of Internal Workstations, new Wang bit-mapped terminals that have a base price of \$1,835 for all but the system monitor.

A four-user Advanced Personal Computer configuration with an eight-slot chassis, 2M bytes of internal memory, a 1.2M-byte disk drive, 67M-byte Winchester drive, monochrome monitor with CGI card, three Internal Workstations, four keyboards and Xenix will cost \$17,465, the company said.

Wang also intends to offer Interactive System Corp.'s IN/IX, another AT&T Unix version, on both the Professional Computer and the Advanced Professional Computer in second-quarter 1986.

IN/IX role on larger systems

Hinting at a role for IN/IX on larger Wang systems, Helayne Jones, director of desktop systems, said the operating system "is tied closer to our strategy than Xenix is." However, no IN/IX pricing was announced.

Additionally, Wang said it will open its architecture for the Professional Computer line, offering specifications to third-party software and hardware developers.

More information is available from Wang at One Industrial Ave., Lowell, Mass. 01851.

DG from page 6

and 3½-in. diskette drive and up to 640K bytes of internal memory. With two diskette drives, the Model 1 is \$2,565, and the Model 2 is \$2,880. With a 10M-byte internal hard disk and one diskette drive, the Model 1 is \$3,460, and the Model 2 is \$3,775. With 640K bytes of memory, one diskette drive and a 10M-byte hard disk, the Model 1 is \$4,095, and the Model 2 is \$4,410.

Deizompo said the MV/4000 DC was enhanced to support up to 32 users, twice the previous number, as a statement of support for the departmental cluster concept, under which personal computers are linked with a mini acting as a file server. When running CEO, however, only 24 users are supported because of the need to

free ports for use with printers, he noted.

A typical MV/4000.DC system, including a processor with 4M bytes of memory, 22 workstations, an IEEE 802.3 transceiver and cable, two 120M-byte disk drives, a diskette drive, three letter-quality printers and DG's AOS/VS operating system package, which includes CEO, costs \$107,448.

Also introduced for use with the Dasher/One was the \$650 Model 4467 printer, a daisywheel printer offering underlining, bold printing and subscripting and superscripting, among other features, according to the vendor.

Additional information is available from DG's Information Systems Division, 4400 Computer Drive, Westboro, Mass. 01581.

ACQUIRE from page 1

of Cambridge, Mass., acquired the assets of Wellesley, Mass.-based Software Arts, Inc., including the now-defunct Visicalc program; and Software Publishing, Inc. acquired Harvard Software, Inc. and its market-leading project management product line.

Analysts have been predicting for some time that successful small software vendors will be grabbed by the few larger companies as the still-young industry goes through a maturation process and shakes out the hundreds of one-product companies that lack marketing resources.

One industry insider recently told *Computerworld* that the four leading microcomputer software companies — Ashton-Tate, Lotus, Software Publishing and Microsoft Corp. — could virtually have their pick of smaller companies seeking acquisition by the giants. "Each of these four has a table virtually full of offers from smaller vendors," according to Benjamin Rosen of the Sevin-Rosen venture capital firm, "and they can now mix and match to fit their own product lines [best]."

Series of consolidations

Concerning the Multimate/Ashton-Tate pairing, Bill Abbondi of Future Computing, Inc. noted that it is the first in what could be a series of consolidations among the leaders of microcomputer software companies. "Ashton-Tate won't be the only one acquiring other firms that lack some distribution skills," he said. It may not be the last of Ashton-Tate's acquisitions as well, according to Abbondi.

The acquisition also gives Ashton-Tate a strong East Coast presence and a pipeline into the substantial East Coast programmer talent pool, a critical consideration in future Ashton-Tate software development plans. The Southern California-based firm has been seeking such a base for some time



Chief executive officer - Wilton Jones
Headquarters - East Hartford, Conn.
Employees - Approximately 220
Revenue - \$21 million (Fiscal year ended March 31)
Profits - \$2 million (Quarter ended June 30)
Primary product - Multimate Professional Word Processor

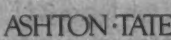
and has been in ardent pursuit of Software Arts, before that acquisition candidate chose to be swallowed up by Lotus.

In the fiscal year ended Jan. 31, publicly held Ashton-Tate's sales were \$82 million and profits were \$7.5 million, ranking it behind micro software vendor Lotus, which had a revenue of \$156.9 million.

Founded in 1980 by Hal Lashlee and the late George Tate, Ashton-Tate's product line includes Dbase II, a popular data base package, Dbase III and Framework, an integrated spreadsheet, graphics, data management, forms processing and outline generator package.

Multimate was founded in 1982 under the name Softword Systems, Inc., by programmer Wilton Jones. In 1984, the company changed its name to Multimate.

East Hartford, Conn.-based Multimate claims to have approximately 30% to 35% market penetration of microcomputer word processing software within corporate installations. Multimate's Executive Vice-President Richard Lefebvre said his company plans to take advantage of Ashton-Tate's es-



Chief executive officer - Edward Esber
Headquarters - Culver City, Calif.
Employees - Approximately 475
Revenue - \$82.3 million (Fiscal year ended Jan. 31)
Profits - \$7.5 million
Primary products - Dbase II, Dbase III, Framework

tablished marketing and distribution network.

Shareholders of privately held Multimate will receive one million shares of Ashton-Tate stock, valued in excess of \$11 million, and cash for a total package value of \$19 million. Multimate will be operated as a wholly owned subsidiary of Ashton-Tate.

The merger agreement must be approved by the boards of directors at both companies and is expected to be finalized by November, company officials said.

In June, Multimate announced plans to port its word processing software to the IBM System/36 minicomputer and to IBM mainframes. Esber said Ashton-Tate will reassess the prospects for mainframe versions of Multimate.

At the time of the announcement, Multimate indicated it had enough cash on hand to complete the project. "The [Ashton-Tate] deal was not made for financial reasons," Lefebvre said.

Ashton-Tate was actively seeking a merger partner in the word processing arena, according to Esber. Chief competitor Lotus currently has no strong word processing element in its product line.

NEWS

PE supermini bolsters parallel processing offerings

By Tom Henkel
CW Senior Editor

OCEANPORT, N.J. — Claiming to have completed the second major step toward making a parallel CPU architecture the mainstay of its product offerings, Perkin-Elmer Corp. last week added a mid-range parallel configuration to its Series 3200 line of superminicomputers.

Called the 3230MPS, the system is based on a newly announced mid-range uniprocessor, the 3230XP, which serves as a host in the 3230MPS configuration. To the 3230XP, users can add up to six processors that function with the 3230XP in a tightly coupled fashion. The add-on processors can consist of auxiliary processing units, I/O processing units or a combined auxiliary processing-I/O processing unit.

The 3230MPS is the second parallel configuration announced by PE in the past six months. In January, the company announced the 3260MPS, a high-end parallel system based on its 3250XP processor [CW, Feb. 4].

The two parallel configurations come in the face of stiffer competition for a share of the scientific-oriented superminicomputer marketplace. PE, a 10-year veteran in the scientific market, is now facing competition from start-up companies offering specialized processors geared to number-crunching tasks.

Unit ties IBM, Net/One tools

SANTA CLARA, Calif. — Attempting to move its local-area network line squarely into large corporations, Ungermann-Bass, Inc. has announced two network interface units that enable its Net/One to communicate with IBM mainframes.

The products, NIU-74 and NIU-78, act as intermediaries between IBM 3274 controllers and Ungermann-Bass' local-area network line. The local-area net line works with four types of media: broadband, baseband, optical fiber and coaxial cable. The broadband network operates at a speed of 5M bit/sec.; the other versions work at speeds up to 10M bit/sec.

The NIU-74 sits between a Net/One network and an IBM 3274 controller. It provides up to 16 coaxial connections each at a maximum distance of 100 ft and routes information from a host to its proper place on a Net/One.

The NIU-78 supplies eight ports that can be used for IBM 3270 Type A devices. These devices can be connected through coaxial cables.

With the interface units, a Net/One network can support IBM 3278, 3279, 3178, 3179 and 3180 terminals as well as IBM 3287 and 3262 printers. The gateway works with IBM Systems Network Architecture and Binary Synchronous Communications protocols.

The NIU-74 costs \$5,425, and the NIU-78 sells for \$4,900.

Ungermann-Bass is located at 2560 Mission College Blvd., Santa Clara, Calif. 95050.

Recent entrants into this marketplace, such as Intel Corp. with its Intel Personal Super Computer system, Encore Computer Corp.'s Multimax and Floating Point Systems, Inc.'s Flex/32, are hoping that systems based on multiple microprocessors will be attractive enough to end users to steal market share away from established vendors such as PE.

Said to be aimed at both scientific and commercial users in need of high computational and I/O capabilities, the 3230MPS reportedly offers users the option — by adding additional processors — of a fivefold increase in performance over a basic 3230XP processor without having to change the host CPU. The system is available

with a minimum of 2M bytes of main memory but can be expanded to 16M bytes. It offers up to two direct memory access channels, each capable of supporting a data transfer rate of 10M byte/sec., the company said.

The 3230XP CPU includes 4K bytes of writable control storage, an automatic restart feature and a multiperipheral controller board. Existing users of PE's 3230 CPU can upgrade to the 3230XP configuration via a \$20,000 field conversion option. In addition, each of the parallel processors that can be attached in the 3230MPS configuration offers 4K bytes of direct-mapped cache memory.

Like other members of the PE 3200

family, the 3230XP and 3230MPS can use PE's OS/32 operating system, a version of AT&T's Unix operating system.

A basic 3230XP with 1M byte of main memory costs \$85,000. Additional processing units that compose the 3230MPS configuration cost \$44,000 each for the auxiliary processing units and I/O processing units and 48,800 for the combined auxiliary processing-I/O processing units. A six-CPU 3230MPS configuration would cost roughly \$325,000 to \$500,000, the company said. The systems are available immediately.

More information can be obtained from PE, 2 Crescent Place, Oceanport, N.J. 07757.

A practical, easy-to-read text...

MVS TSO

Concepts • Commands • ISPF • CLIST

If you're developing programs under OS/MVS, you're probably using some type of time-sharing system. If that time-sharing system is TSO, a book called *MVS TSO* is for you. It zeroes in on the tasks a programmer has to do most often, so you can master TSO in a hurry.

Here's what you'll learn, whether you're using native TSO or ISPF (a menu-driven extension to TSO)

- how to create or change a data set or a library member
- how to allocate, display, print, rename, delete, move, or copy a data set
- how to compile, link-edit, and execute a program interactively
- how to debug a COBOL program interactively—that is, how to monitor the program's execution, look at the contents of data fields, watch the order in which subprograms execute, and so on
- how to start and control background processing for batch jobs (a background job doesn't run in your time-sharing region, so your terminal's not tied up as the job executes)
- why you have to use native TSO commands for some functions even if ISPF is available on your system

In short, you'll learn everything you need to know to use TSO commands or ISPF for program development.

For experienced TSO users:
How to use command procedures

MVS TSO will also teach you how to use command procedures, or CLISTs. A

CLIST is a series of TSO commands and statements that are executed in sequence (it's roughly equivalent to a JCL procedure). In this book, then, you'll find out:

- how to create and execute a simple CLIST for a specific job
- how to create and execute a generalized CLIST that can be used in a number of situations
- how to write a complex procedure that uses facilities much like those of a high-level language
- when and why you should write a program in a high-level language instead of using a CLIST

2 reasons why this book works

1. A technical subject like TSO is easier to master if you have plenty of practical examples to study. That's why *MVS TSO* is loaded with illustrations. For example, you'll find:

- before-and-after screen images that show you what values to enter into a screen and what the result will be
- TSO command formats that clearly explain each operand
- sample CLISTs
- schematic drawings that show how TSO works and how it relates to MVS

These illustrations not only help you understand TSO in the first place. They

also serve as handy references when you're working at your terminal.

What's more, they teach you the basic patterns of TSO commands and ISPF options. So you won't have any trouble looking up new features in the IBM manuals or other references when...and if...you need them.

2. This book is organized in a way we've found works well. After chapter 1 (an introduction to MVS and TSO), the book is divided into 3 parts: one each on ISPF, TSO commands, and CLIST. So if ISPF isn't available at your installation, you can skip that part and concentrate on native TSO. If you already have TSO experience, you can go directly to the part on CLIST.

In other words, you can study the parts you want to, when you want to.

So why wait to become a TSO expert?

Get a copy of *MVS TSO* today. I think you'll be delighted at how quickly you'll master TSO.

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OS JCL teaches you how to code job-control language for everyday applications that involve sequential, direct, ISAM, or VSAM files. If you're a TSO user, this book will help you understand why you have to supply JCL for some TSO jobs and what that JCL should be.

Why take the time to write a program in a high-level language when you can use a utility program instead? *OS Utilities* teaches you to use 13 time-saving utilities, including IEBGENER, IEBPTPCH, IEBISAM, IEBUPDTE, IEFBR14, Sort/Merge, and IDCAMS.

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Dear Mike: Please send me the books I've indicated below. I must be completely satisfied, or I'll send them back at any time for a full refund.

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- ☐ Bill me for the books plus UPS shipping and handling (and sales tax in California.)
- ☐ Charge the books plus UPS shipping and handling (and sales tax in California) to my Visa MasterCard: Card number _____ Valid thru (mo/yr) _____ Cardowner's signature _____ (not valid without signature)
- ☐ I want to SAVE shipping and handling charges. Here's my check or money order for full payment. Calif. residents, please add 6% sales tax to your order total. (Offer valid in U.S.)

Name & Title _____
Company (if any) _____
Address _____
City, State, Zip _____ T1/4

NEWS

Winnebago, Forest City travel down automation road

By Paul Korzenowski
CW Staff

FOREST CITY, Iowa — One probably would not expect to find a half-billion-dollar corporation in a city so rural that it lacks a fast-food franchise.

Neither would one anticipate that in-depth computer training programs would be run at high schools so tiny that each graduating class consists of fewer than 30 students.

But that is what one finds here in this town of 4,000 in northern Iowa, home to acres of cornfields and Winnebago Industries, Inc.

One cannot underestimate how important Winnebago is to this farm area. When times are good for the recreation vehicle manufacturer, which employs 2,500 workers, then good times come to Forest City residents.

Tough times at Winnebago

In the early 1980s, times were tough for Winnebago. New competition, unrealistic sales projections and unstable gasoline supplies and costs had turned a stream of steady profits into an \$18 million river of red ink.

To stem the tide, major changes were made. John K. Hanson, the company's 71-year-old founder who had stepped away from an active role in the company in 1975, returned. With Hanson came an emphasis on automation, especially factory automation.

That new emphasis brought a corresponding increase in the use of corporate mainframes. The addition of product design and factory control applications had overloaded the company's IBM 4341 mainframe.

To ease the burden, an IBM 4381 was installed in the fall of 1984, and business applications such as a payroll system were off-loaded to it.

System still taxed

Despite the additional horsepower, the company is still taxing its systems. "Both mainframe systems are operating at full capacity, and we will have to upgrade them shortly," noted John Rieff, advanced technologies manager at Winnebago.

Part of the reason for the squeeze on its systems was that the compa-



Winnebago Industries, Inc. manufactures recreational vehicles in rural Iowa.

ny's business had once again begun to prosper. Hanson's leadership and a new line of smaller, lighter recreational vehicles helped to turn the business around.

Another reason for the increased automation was that, like other manufacturing companies, Winnebago has been exploring how computers can aid design, manufacturing and production processes. "When [General Motors Corp.] is ready to unveil its factory of the future, we want to be ready with ours," Hanson said.

Rieff is charged with realizing Hanson's vision, which has a target date of 1988. The advanced technologies manager is a member of a computer-integrated manufacturing (CIM) committee, whose job is to determine how Winnebago should automate its production processes.

"CIM is more than just [computer-aided design and manufacturing]," he said. "It incorporates concepts such as distributed processing so that corporate information can be spread throughout a company and used wherever it is needed."

CIM committee

The CIM committee consists of middle and upper level managers from a broad range of departments, including marketing and various Winnebago factories. Rieff will not

have to school other members in computer fundamentals because three years ago Winnebago embarked on a comprehensive computer literacy program.

The program included computer literacy training classes for any employee interested in learning how the machines operate. The classes supplied a basic understanding of simple concepts such as input and output.

Also, a microcomputer learning center with a full-time in-house consultant was established. Employees can visit the center at any time. After they tell the consultant how they work, the consultant may recommend a package that the person can try out. If a user determines that a computer could help him do his job better, he or his manager can purchase it.

"There really isn't much of a risk," Hanson claimed. "It is only

\$5,000 and a company this size can afford to spend that amount of money without a guaranteed return."

The center supports equipment from various vendors including IBM, AT&T, Hewlett-Packard Co. and Apple Computer, Inc. "I think any employee should be able to work with whatever type of equipment he feels comfortable with," Hanson said.

Computer phobia held back execs

The only problem with the program was senior executive computer phobia. "I could not believe the resistance some of the senior managers had to working with the machines," Hanson claimed. "It took a real long time for them to overcome their fears."

Today, the microcomputers are primarily used in stand-alone fashion for typical spreadsheet and word processing applications. In order for CIM to become a reality, this data has to be integrated with other corporate information, according to Rieff. Consequently, the company has begun to look at some network alternatives.

In addition to productivity increases, Hanson saw another benefit to the campaign. Today, more microprocessors are used by the automobile industry to control engine activities than by the computer industry to control data processing. "When our engineers know how a microprocessor works, they may be able to incorporate them into the design of our products and save us money," he said.

Might we see a recreational vehicle equipped with a personal computer for someone who wants to take a spreadsheet on vacation? "Our customers tend to be older and are not very interested in vehicles equipped with microcomputers," Hanson said.

City schools go high tech

FOREST CITY, Iowa — John Rieff, advanced technologies manager at Winnebago Industries, Inc. here, thinks that residents of Forest City are more computer literate than those in many major cities.

One reason is an aggressive literacy program that local schools have undertaken with the help of the recreational vehicle manufacturer. In Forest City, computer classes are available for local students from the first grade through the community college, due in large part to Winnebago's efforts.

Since 1982, Winnebago has donated more than 190 computers from different manufacturers to 20 local schools, according to a company spokesman. Some of the machines had been used at Winnebago and were replaced by newer models. Others were new machines.

One reason behind the gifts was the generosity of John K. Hanson, chairman and chief executive officer of the company. A second was that the computers were used to complement Winnebago's corporate computer literacy program. "If a worker came home and saw his child working with a computer, he might be embarrassed into learning

how it worked," Hanson explained.

The only string attached to the donations is that the schools periodically report how the microcomputers are being used, according to the spokesman. Primarily, they are used to introduce the machines' capabilities to students who otherwise might never see one.

In addition to arranging his company's donations, Hanson sat down with an executive from Control Data Corp. CDC claimed that its Plato training program is second only to the U.S. Department of Defense's effort to provide Americans with computerized training. Plato is a series of automated training tools, a number of which are geared to elementary and secondary educational institutions.

After Hanson had talked to the CDC executive, Plato program materials were made available to some local schools, and a few teachers were sent to CDC for training.

Despite a costly investment, Winnebago has not yet reaped any tangible benefits from the programs. "But in a few years, we will be able to choose employees who will be best able to put computers to work for the company," Rieff predicted.

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NEWS

RYAN from page 1

an MBA and learned the uses of technology in bank management positions. Ryan, on the other hand, is a mathematics major whose career has followed much more traditional data processing lines.

Ryan graduated from Providence College in Providence, R.I., and joined Datatrol, a software company in Washington, D.C., that was soon acquired by Control Data Corp. Starting out as a systems analyst at Datatrol, Ryan left CDC eight years later as manager of the Washington, D.C., office.

He joined Chase Manhattan in 1972 as a DP project manager. In those days, he said, a project manager "designed systems and wrote code, mostly in assembler language," along with everyone else.

In 1975, Ryan's responsibilities were enhanced to include securities data processing, and he proceeded through a succession of DP management posts during the next few years.

In banking, data processing is inextricably linked to bank operations, such as check processing or wire transfers, and in the process of supervising such operations, Ryan assumed general responsibility for the staff attached to it as well as the computer systems and personnel involved. In 1981, for example, when he became head of electronic data processing, Ryan also assumed responsibility for all Chase Manhattan clerical personnel devoted to check processing, securities and trust services and other operations.

Banking industry insiders note that Ryan's move from technical responsibility to supervision of a growth area of the bank might have been difficult for a more traditional MIS executive to make. Computer management and people management "have been intertwined throughout his career," said a Chase Manhattan observer.

Nevertheless, Ryan is an advocate of technology and thinks it holds the key to bank consumer services.

"Technology is becoming dominant in the delivery of services. . . It is the highway to get our product to the consumer," he said.

Whereas the branch bank was once the preferred delivery vehicle for financial services, the high overhead of bricks and mortar and the potential of electronic technology has now made automated services more attractive, Ryan said. Another factor in their appeal, he said, is that many bank customers actually prefer to deal with machines in some transactions.

As computers take over more of the routine tasks at a bank, the service people will be able to act more like salesmen and less like order takers, Ryan continued. In this context, the automatic teller machine, viewed by some as the epitome of impersonal service, actually frees staff to interact with customers as service and sales personnel.

The major banks have already installed the back-office computer services that clear checks and allow ATMs to process on-line transactions. Modern communications enable these services to extend their reach. When combined with the ability to organize information through data base management, the result "has been nothing short of extraordinary," Ryan said. But technology

will play an increasingly direct role in consumer banking, he said.

One of Ryan's visions is of a day when banks place terminals in real estate brokers' offices, through which brokers can access listings of property for sale along with mortgage rates available from local banks. Such terminals, said Ryan, would be able to host programs that could analyze the borrowing limits of a house hunter, speeding his search and initiating the mortgage application process.

The Chase executive believes that computerized home-banking services have a promising future independent of the questionable future of the

home computer market. Chase declined to reveal the number of home-banking customers it serves, but it has the capacity to execute normal

banking transactions as well as discount stock buying through Chase's subsidiary, Rose & Co., in Chicago. On this system, customers may view up-to-the-minute values of their portfolio and order trades to be executed the following day after regular trading hours.

With technical support, Chase can open small business loan of-

fices or personal financial centers and staff them with sales people and minimal support personnel. It operates 13 business offices and two personal financial centers in the New

York area. It also operates a mortgage office on Staten Island, N.Y.

Ryan also believes that it is only a matter of time before the courtesy cards that allow customers to access their accounts at ATMs begin to function as debit cards, usable at many retail stores. Instead of writing a check, a transaction would be routed electronically to the customer's bank and the amount deducted from his account. Such a step would be aided by emerging videodisk storage techniques that can store greater quantities of information and still make it available quickly.

"The amount of information that people want appears to be unlimited, but it is limited by cost and convenience," Ryan said. Consequently, Chase is turning to technology to help it provide information and service at a reasonable cost.



Ryan



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NEWS

Greene OKs private-line switching by divested Bell firms

Decision permits rerouting onto long-distance circuits

WASHINGTON, D.C. — U.S. District Judge Harold Greene recently declared that the regional holding companies can provide switching services at their exchanges for private-line customers who want to route local calls onto long-distance circuits. The decision gives the divested Bell operating companies clearance to configure private networks that service multiple exchanges while keeping them out of the long-distance business.

Greene said it was permissible for Pacific Northwest Bell Telephone Co. to carry out a reconfiguration of the state of Oregon's private intrastate multiechange network where three nodes were established that were able not only to switch local calls but to switch local calls onto long-distance circuits.

While Greene's decision is being viewed by the U.S. Department of Justice, which oversees the enforcement of the AT&T divestiture decree, as specifically pertaining to the Pacific Northwest Bell case, other observers say the court order could spark new efforts by the divested Bell operating companies to play a larger role in the configuration of networked communications across exchange boundaries, especially for large-volume corporate users.

Bell Atlantic Corp. said, "The decision . . . enhances our ability to compete for large customers as long as we don't provide interexchange circuits." Bell Atlantic noted that it is currently seeking to provide a similar network configuration service to the state of Virginia.

Richard M. Wolf, executive vice-president of Robert E. LaBlanc Associates, a Ridgewood, N.J.,

telecommunications consulting firm, said the Greene decision "represents a clear softening of the interexchange prohibition demarcation line" for the divested Bell operating companies contained in the original divestiture decree. However, he cautioned that the effect of the Pacific Northwest Bell decision will be limited and represents Greene's approval of a state government as opposed to a commercial interest obtaining a similar configuration.

"I do think, however, that intrastate interexchange switching is going to be the area most prone to pressure for change. Here, state utility commissions have jurisdiction and a federal-state issue is presented," he added. AT&T petitioned Greene to test the legality of Pacific Northwest Bell's service, alleging that it was offering an interexchange long-distance service in violation of the divestiture decree and also was engaged in discriminatory pricing by giving lower local rates to private-line customers than to long-distance carriers.

In rejecting the AT&T petition, Greene noted that the divestiture decree forbids the former Bell operating companies from performing interexchange or long-distance routing to particular long-distance carriers, but it does not prohibit them from providing switching services to customers as end users when they want to originate or terminate traffic from dedicated private or tie lines that connect to interexchange circuits as part of a Centrex offering or a private branch exchange (PBX) service.

Greene noted, "Indeed if the [former Bell operating companies] were precluded from providing such services, they would be foreclosed from a substantial portion of the end-user switching and private-line network markets which they currently serve."

Greene said that in the case of Pacific Northwest Bell, the company switched the state of Oregon's interexchange private-line calls onto the private interexchange transmission facilities that were being provided by AT&T at its points of interface. The state switched the remaining calls using on-premise PBX equipment.

Greene said that marketing and engineering functions performed by Pacific Northwest Bell consisted of estimating the number of interexchange circuits the state would need to connect two intraexchange nets, which he said was "an inherent and necessary part of its authorized businesses of providing the intraexchange portion of the customer's private network and of marketing Centrex- and PBX-based private-switching systems and services."

Pacific Northwest Bell did not select the long-distance carrier to be used by the state to connect the nets but rather programmed its Centrex switches to establish connections with AT&T communications circuits that were picked by the state's planning officials.

Greene rejected the AT&T charge of discrimination in local exchange pricing for the same service, even though rates for carrier access were higher than for private network access. He upheld Pacific Northwest Bell's contention that carrier access pricing, unlike local private-line rates, was meant to support local service.

While the Justice Department argued that Pacific Northwest Bell's service was legal, it pointed out that it believed the divested Bell operating companies are prohibited from "designing routing algorithms for tandem routing of interexchange traffic, the selection or recommendation of the long-distance carrier and the procurement for customers of interexchange service from the interexchange carrier."

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Darpa fuels supercomputing

GAITHERSBURG, Md. — A new generation of supercomputers is being born across the U.S., sponsored by money from Uncle Sam.

Already, a new large-scale multiprocessor machine — called the Butterfly Multiprocessor — is up and running and is available for access by researchers who have hookups to the U.S. Department of Defense's Arpanet system. It was designed and manufactured by Bolt Beranek & Newman, Inc. of Cambridge, Mass. The sponsorship of the new generation of supercomputers is being directed by the Defense Advanced Research Projects Agency's (Darpa) Strategic Computing Initiative at a cost, to date, of \$150 million. The goal of the project is to develop advanced machine-intelligence technology during the next 10 years.

In addition to a new generation of supercomputers, other research areas being supported by Darpa include software applications generators to promote AI systems for speech recognition, natural language computer interfaces, vision comprehension systems and advanced expert systems.

The Butterfly machine is the first product to emerge from the Strategic Computing Initiative based on a multiprocessor architecture. In this case, a variable number of processors can be incorporated into the machine, accommodating up to 128 commercially available microprocessors (Motorola, Inc.'s 68000 series). Each processor has access to .5M bytes of memory and the top machine speed is quoted at 200 million instructions per second (Mips).

Bolt Beranek & Newman currently has government commitments of up to \$20 million to build 10 of the Butterfly machines.

A second supercomputer, being developed at Carnegie-Mellon University in Pittsburgh, is a programmable systolic array. The system consists of a configuration of multiple processing elements that is slated to run at a rate of 10 Mips.

A third supercomputer that will be completed this year with support from Darpa is the Connection Machine, manufactured by Thinking Machines Corp., Cambridge, Mass., which will contain 64,000 processors that are connected to each other.

The initial 64,000-node processor machines will be manufactured using very large-scale integration technology of 10,000 gate array chips, each containing 16 processor elements to connect to other surrounding nodes, as well as a communications router, according to the vendor.

The Connection Machine will be directed by a computer at the front end that will instruct the machine on the task to perform at rates potentially as high as 10 billion instructions per second.

The fourth and final supercomputer project being supported by Darpa's Strategic Computing Initiative is under way at Columbia University in New York, where researchers have designed and built a non-von Neuman machine based on a tree architecture that combines up to 8,000 large and small processors. The machine is functionally similar to the Connection Machine.

NEWS

REPORTER'S NOTEBOOK

Ramblings from the floor of Cincom Systems, Inc.'s Directions '85 Executive Management Conference:

■ It may be because of the joint marketing agreement Cincom recently penned with Digital Equipment Corp., but for whatever reason the Cincinnati-based software vendor made DEC representatives feel right at home at its Directions '85 Conference last week.

Two Cincom speakers took time from their presentations to point out that most of the initial development work for the company's IBM mainframe and DEC VAX-compatible software was done on VAX processors. Other representatives, including Chairman and Chief Executive Officer Thomas Nies, described benchmark tests conducted by Cincom that they said illustrated the price/performance superiority of the VAX compared with two classes of IBM mainframes.

Nies also gave attendees a brief history lesson on IBM's introduction of its OS and DOS operating systems, both of which he described as primarily batch oriented.

Nies said the fact that OS and DOS were not designed for on-line environments "was a little error in the beginning that became a big problem over time." Nies labeled DEC's VMS, which he said was designed as an in-

teractive operating system, a product of "modern thinking."

Another Cincom speaker claimed that "many of the links between IBM processors are weak." On the other hand, he told visitors, DEC has been successful in ensuring compatibility among its processors, everything from the VAX 8600 to the Microvax.

■ Asked whether IBM would introduce an operating system successor to MVS/XA later in this decade, Ron Weeks, senior product manager of architecture and business planning, said such an announcement would depend on what Big Blue's



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competition has up its sleeve. "IBM does what its customers want," he said, "but only as fast as the competition pushes it. IBM's solutions are longer term. If you can wait, that's okay."

■ As an aside, Nies said IBM offered to sell the CMS component of its increasingly popular VM/CMS operating system to Cincom some 10 years ago for \$2.5 million. Nies said he declined the offer because "I didn't think we could sell an operating system."

■ John Carpenter, corporate technical consultant with Cincom, told visitors that end users will have to

become more involved in applications development. "We can't move far enough ahead, fast enough, without greater user involvement," he said. "We don't have enough programmers to automate all the functions that need to be automated."

■ Comments made by a Cincom spokeswoman indicated that the company was less than thrilled with the recent National Computer Conference (NCC) attendance. She said the show garnered Cincom about 300 prospects, a smaller group of potential customers than Cincom won at last year's Las Vegas show. However, the figure was not low enough to cause Cincom to consider withdrawing from NCC participation, the spokeswoman said.

Aging systems nag managers



CW AT
DIRECTIONS '85

By John Gallant
CW Staff

NEW SEABURY, Mass. — Picture the DP manager as a long-distance runner. Striding toward the goal of providing information that a company needs to survive, the DP manager must dodge the obstacles tossed up by "technological earthquakes" — the rapid and often incompatible advances in computer and communications technology — according to Ron Weeks, senior product manager of architecture and business planning at Cincom Systems, Inc.

The long-distance DP runner must also carry the millstone of obsolete methods and aging applications.

Weeks was not the only Cincom speaker to draw on the millstone analogy at the company's Directions '85 Executive Management Conference here last week. Thomas Nies, Cincom's chairman and chief executive officer, also claimed that reliance on older technology — especially software — and outmoded approaches to information management are inhibiting advances in MIS.

"The large investment in old software makes it tough to move forward," Nies said. "You cannot drag the old along and hope to make great progress. Advances in software have tended to be evolutionary, while breakthroughs in hardware have been revolutionary. Thus, there is an increasingly large gap between the

See CINCOM page 15

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NEWS

WEST COAST UPDATE/JEFFREY BEELER

Last May, when Apple Computer, Inc. announced that Steven Jobs would assume "a more global role" in the reorganized company's operations, the firm probably had no idea how apt its choice of words would become.

At the time, Apple was consciously engaging in euphemism. Since then, however, Apple's memorable exercise in double-talk has taken on new meaning.

As the San Jose, Calif., *Mercury* recently reported in a front-page news story, Jobs now wants to become an astronaut. Yes, the wunderkind who pioneered the microcomputer industry and became a

prototypical American success story has signed up for a program that gives a select handful of civilians the opportunity to tag along on future space shuttle missions.

In all probability, Jobs' bid to become the first counterculture entrepreneur in outer space will end in disappointment. Only a tiny fraction of the program's horde of eager applicants will ever realize their dreams of roaring off into the yonder.

But if good fortune smiles on Jobs and his application for a space shuttle seat is accepted, his position may someday become infinitely more global than Apple ever imagined.

Jobs' desire to join the space shuttle crew seems an unusual career move. But under the circumstances, his aerospace aspirations are understandable.

Here, after all, is a man who, probably more than anyone else, popularized personal computers, built Apple into a Silicon Valley legend and made himself a millionaire many times over before he turned 30. Then, in one fell swoop, he saw himself unceremoniously stripped of all his day-to-day management duties and reduced to being a figurehead. To add insult to injury, his demotion became fodder for nationwide news coverage and was engineered by an executive he himself had helped recruit.

Compared with the woes that have recently befallen him on terra firma, the perils that await him in the frigid but tranquil void of outer space look positively piddling. Who could blame him for gazing longingly at the spacecraft *Challenger*?

Jobs, of course, is by no means the only one who suffers in the industry these days. Suppose for a moment that the travel agency at Cape Canaveral chartered a special space shuttle excursion just for the benefit of harried members of the computing field. Who or what organizations should be included? A suggested list of passengers follows:

■ IBM President John Akers. Having originally predicted improved earnings for the company in 1985, Akers later found himself in the uncomfortable position of retracting his earlier statement and announcing the industry giant's first quarterly down-

turn since God knows when. One nagging question about Akers' space shuttle participation still lingers, however. As a concession to IBM, will mission organizers be willing to issue dark, three-piece space suits with pin stripes?

■ Apple President John Sculley. Although he has effectively rid himself of the bothersome Jobs, Sculley still faces the unenviable task of leading his firm into battle against Big Blue on its own home turf. Red ink and postreorganization tumult also qualify Sculley for an outer space getaway. But if Apple's recent past is any guide to its future, Sculley will arrive at the launching

pad only to find that all the space shuttle seats are already occupied by IBM staff.

■ The Internal Revenue Service. A collection of new IRS computer systems that were supposed to speed the processing of this year's tax returns had the opposite effect. An unusually large number of refund checks were significantly delayed. But even if the modified systems had worked perfectly, the IRS would probably win a place on the space shuttle by acclaim. Most taxpayers would probably rejoice at the thought of hurling their revenue agents at warp speeds in the direction of Alpha Centauri.

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BDPA meet slated

PHILADELPHIA — The Black Data Processing Associates (BDPA) has scheduled its seventh national convention for Sept. 20 and 21 at the Franklin Plaza Hotel here.

The conference will include seminars and exhibits from a number of vendors. Some of the sessions topics include data base strategies, local-area networks, an introduction to AT&T Unix and artificial intelligence. The keynote speaker will be Carl Singley, dean at Temple University's school of law.

The convention costs \$210 for BDPA members and \$225 for nonmembers.

More information is available from BDPA National Convention, P.O. Box 7466, Philadelphia, Pa. 19101.

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NEWS

Four-part approach seen key to integrated applications



CW AT
DIRECTIONS '85

By John Gallant
CW Staff

NEW SEABURY, Mass. — MIS managers must ensure that four key software components are in place if they want to provide users with a completely integrated applications portfolio.

At the heart of such a portfolio, according to Thomas Womeldorff, senior product manager for Cincom Systems, Inc., is a data base management system (DBMS) that provides a common data resource for all applications and network management tools that allow data to be shared among processing environments within a company.

Speaking at Cincom's Directions '85 Executive Management Conference here, Womeldorff said a second vital component is a set of applications for what he labeled "predictable" business functions, such as general ledger or order entry. Supplementing those standard applications, he said, is a fourth-generation language that allows an MIS department to build systems for unique needs or to customize vendor-supplied packages.

The final component, Womeldorff said, includes data retrieval and decision support tools for meeting unpredictable information needs.

According to Womeldorff, such a portfolio offers the following three levels of integration:

■ **Data integration**, which ensures that "a single definition of all corporate information is viewed and updated by all business events or activities."

■ **Transactional integration**, which means that a single transaction is used to record an event. The transaction — for example, the entry of a customer's order — updates operational records, such as inventory, feeds financial tracking systems and triggers feedback to planning systems.

■ **Operational integration**, which Womeldorff described as a single

menu and security system and a standard screen design that allows users to initiate transactions easily and move between applications.

"The quality of a company is more and more related to the quality of its planning, operational and financial tracking systems, all of which must be linked to ensure that information flows swiftly throughout," Womeldorff said.

Despite the obvious benefits of such integration, he said, very few companies have all the components in place. Why?

"The cost and difficulty of developing an integrated applications portfolio in-house are prohibitive," he said. "You would essentially be

building one huge application. That is a job that has outgrown virtually every company.

"Also, many applications vendors have specialized in specific areas and do not support a full spectrum of packages. Even within one vendor's line, packages are not completely integrated."

"It seems so logical to have integrated applications," Womeldorff continued. "Some smaller companies just starting out can build a portfolio more easily. But larger companies with older applications in place find it very hard to do. It is a long-term project that requires you to consider applications on a companywide basis."

CINCOM from page 13

capabilities of software and the growing potential of hardware.

As an example, Nies said that roughly 85% of users are still using Cobol. "Cobol was born in the late 1950s when they still made DeSotos and vacuum tube computers. Today, the programmers are younger than the languages they use," he said.

But Nies, whose company is one of the leading vendors of systems software and an important player in the applications market, laid the blame for sluggish advances in MIS not on users, but on software vendors.

"Vendors are interested in account control, locking customers into their systems. 'It is not the customer's fault,' he said. 'It is the vendor's fault.'"

Nies warned that locking in users also locks in vendors — a point that Weeks addressed. "We are witnessing a spreading out of applications to all levels in a company," he said. "The trick is to move data and processing (functions) between a variety of systems. Success will come when users can decide what is the most optimal use of resources."

"The only way hardware and software vendors can sell more products is to help users reach that goal," Weeks concluded.

The key, Nies and Weeks said, is for vendors to provide software that is insulated from its environment and provide the tools users need to exploit and integrate new technologies. The biggest obstacles, Nies said, are "the idea that things should be done the way they always have and ... the entrenched power groups who block technological advances."



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NEWS

IBM wins FAA job for CPU replacement

By Mitch Betts
CW Washington Bureau

WASHINGTON, D.C. — The Federal Aviation Administration (FAA) recently awarded IBM a contract with a potential value of \$432 million to replace the existing IBM 9020 mainframes at 20 air-traffic control centers.

The replacements will be IBM 3083 Model BX1 units, with each installation consisting of a primary processor with a backup unit, FAA officials said.

IBM was awarded the contract following a 21-month design competition with Sperry Corp. According to the FAA, the selection was based on cost and performance factors, including the results of a "compute off" between the two candidate systems at the FAA Technical Center near Atlantic City. A key factor in the evaluation was the ability of the IBM system to host the current 9020 software package with minimal modifications, officials said.

Award made despite criticism

The contract award was made despite criticism from the U.S. General Accounting Office that the FAA tests were insufficient because they did not simulate the heavy work load expected in the late 1980s.

FAA officials said the IBM 9020s, installed in the early 1970s, must be replaced because they lack the storage capacity and processing power to handle the increasing volume of air traffic in the U.S.

Furthermore, according to Secretary of Transportation Elizabeth Dole, "the new computer will have the capacity to assume added functions — such as improved conflict detection and resolution — permitting the FAA to make more efficient use of controllers."

Options could increase value of contract

Dole said the basic value of the contract is \$196.9 million, but options for future hardware maintenance, software and technical support could increase the value of the contract by an additional \$235.1 million.

The contract calls for IBM to deliver the systems to the air-traffic control centers over a one-year period, beginning next summer. Similar units will be delivered to FAA technical centers to use for training purposes.

The FAA expects to use the IBM mainframes until about 1990, when it plans to install an advanced generation of computers for air-traffic control. IBM and Hughes Aircraft Co. are now engaged in a three-year design competition for the Advanced Automation System [CW, Sept. 3].

The IBM 3083 systems will provide "a stable transition vehicle to our advanced automation program in the future," Dole said.



WASHINGTON
UPDATE
CW Washington Bureau

GAO maintains firm misled SSA

WASHINGTON, D.C. — The U.S. General Accounting Office (GAO) recently reaffirmed its contention that Paradyne Corp. misled the Social Security Administration (SSA) about the status and availability of data communications equipment that it demonstrated in 1980 to win a \$118 million contract.

The GAO was asked by U.S. Rep. Jack Brooks (D-Texas), chairman of the House Committee on Government Operations, to review two affidavits that Paradyne submitted to fight a government proposal to bar Paradyne from obtaining future contracts [CW, March 18].

The affidavits, submitted by George Whit Dodson, a retired government procurement official, and Joseph M. Fox, a former IBM official, asserted that Paradyne did not mislead the SSA in its proposals or equipment demonstrations [CW, April 22].

Dodson's affidavit said that it is a common practice in the computer industry to use the present tense to describe products that are not yet available. The GAO disagreed and said the SSA bid request specifically sought hardware that is "available to the general user."

Referring to the fact that Paradyne demonstrated a Digital Equipment Corp. PDP-11 processor instead of the Zilog, Inc. Z8000 processor proposed in its bid documents, Dodson and Fox said the processors had the same functional capabilities. The GAO auditors said that although both are 16-bit processors, in almost every other technical respect, they are dissimilar.

Worldwide DP system hits snags

WASHINGTON, D.C. — The U.S. Department of State is having some problems with the installation of its worldwide distributed data processing system for financial management, according to a review by the U.S. General Accounting Office (GAO).

A recent GAO report cited the following difficulties:

- Air-conditioning and air pollution problems interfered with installation of a minicomputer at the Cairo site for several months. Also, the center at Abidjan, Ivory Coast, has experienced serious electrical failures.

- Systems managers in Bangkok, Thailand; Brasilia;

New Delhi; Cairo; and other sites reported difficulties in getting timely maintenance services.

- The State Department has experienced delays in installing high-speed data communications lines for a variety of reasons, including the fact that facilities in some lesser developed countries are not suited for high-speed communications.

The GAO report said the State Department is well aware of the problems and is taking action to overcome them.

Audit finds DP center lacking

WASHINGTON, D.C. — The U.S. Department of Agriculture's National Finance Center in New Orleans, which provides financial DP

services for the agency, needs to improve the security and reliability of its DP operations, according to a government audit.

In a recent report, the U.S. General Accounting Office (GAO) said the DP center lacked a formal disaster recovery plan and had outdated and incomplete software documentation that hindered system maintenance.

Furthermore, the GAO's report said, software changes were not independently tested nor reviewed for integrity, and some personnel had access to both the data files and the financial programs, raising privacy and security concerns.

U.S. Department of Agriculture officials reported that steps have been taken or are planned to address the GAO findings, but all of the necessary actions have not yet been completed.

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NEWS



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TOKYO — Hitachi Ltd. announced last week a \$120 million dollar program to purchase equipment immediately in the U.S. in response to Japan's heralded "Action Program," which is intended to rectify the U.S. trade imbalance. The company said this money would be in addition to the approximately \$260 million it already spends annually on American products.

At a press conference held in Washington, D.C., Executive Managing Director Toshi Kitamura also announced an increase of Hitachi investments in the U.S. for the next year, with the opening of additional manufacturing plants. Also announced was the Hitachi Foundation, an endowment of \$20 million earmarked for "continuing and expanding the company's support of joint educational research projects, scholarships, cultural and charitable programs in the U.S."

A 10-member import promotion team will arrive in the U.S. in August with orders to promote purchasing arrangements with U.S. companies. Four areas have been targeted for the purchase agreements: production facilities and equipment, research and development equipment, more long-term purchase contracts for U.S.-made semiconductors and long-term purchase contracts for U.S.-made communications equipment. A Washington, D.C.-based corporate affairs office will also be established, a Hitachi spokesman said.



TOKYO — NEC Corp. will act as the Japanese distributor of General Electric Information Services Co.'s (Geisco) worldwide teleprocessing services here, according to an announcement made last week. NEC's clients in Japan will be able to obtain teleprocessing services provided by Geisco's international network as of Oct. 1, according to a spokeswoman. The interconnection of Geisco's service with NEC's own Japanese value-added network will significantly expand business opportunities for both companies, NEC added.



EDGECLIFF, Australia — A market research firm here has predicted that IBM will manufacture Csilronet's AT&T Unix-based multiprocessor microcomputer, Miconode, here for worldwide sales. The move is an effort to counter sales of Digital Equipment Corp.'s Microvax II technical workstation, according to a report by the Yankee Group.

Two weeks ago, Csilronet announced a deal with the Sydney software house of Neology Ltd., which was to port Unix onto the Miconode. At the time, Csilronet said it was negotiating with a "multinational computer company that had manufacturing facilities in Australia" to produce the Miconode here. Meanwhile, an IBM product, code-named Quicksilver, believed to be the Miconode, is due to be announced soon. The Yankee Group report claims that since DEC's Microvax II was released last May, IBM has faced increased pressure to show its hand in the market

for technical workstations.



CANBERRA, Australia — Australia's international promise to look at developing long-term copyright protection for computer software might not be kept, a senior public servant has warned.

The pledge was made not only in the Parliament but also before a United Nations body specifically convened to consider software copyright at international levels. Sources in the attorney general's department here believe that the international community is not close to a consensus and called ordinary copyright laws acceptable, if not ideal, for the protection of software. It is thought that Australia will soon merely amend current copyright laws to cover computer programs, just as the UK,

France and West Germany have done this year.



PERTH, Australia — Claiming that there are no Australian consultants with expertise in integrated mining systems, Alcoa Ltd. has employed French contractors to set up a mainframe recently ordered from National Advanced Systems, Inc. (NAS). The 16-channel NAS 8063 with 24M bytes of main memory scheduled for delivery in September will replace an IBM 3033N.

Like the IBM 3033N, the NAS mainframe will run in parallel with a second IBM 3033U.

The parallel configuration supports a 400-terminal network encompassing three refineries and four mine sites in Western Australia, as well as three Victorian facilities.



SYDNEY, Australia — Criminals thinking that they may have pulled off successful capers in the past have cause to worry. The New South Wales Police Department purchased a \$5.7 million system that matches fingerprints at a rate of 2,310 prints per second and successfully matches partial prints with accuracy previously unobtainable, a police spokesman said. The order for the automated fingerprint system went to NEC Information Systems Australia Pty. Ltd., which won the bid over three other vendors on the basis of speed, optical disk capacity and applications software. NEC has supplied similar systems to police departments in California, Alaska and Japan, but this is said to be the company's first Australian mainframe order.

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NEWS



CALENDAR

WEEK OF SEPTEMBER 1

SEPTEMBER 3, NEW YORK — **Vsam: Its Structure and How to Use It.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024. Also being held Sept. 5, 10 and 12 in New York.

SEPTEMBER 3-4, CHICAGO — **CICS/VS Performance and Tuning.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024.

SEPTEMBER 3-6, ATLANTA — **Vtam: From Start to Finish.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024.

SEPTEMBER 3-6, FORT LEE, N.J. — **IMS/Data Communications Programming.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024.

SEPTEMBER 3-6, SAN ANTONIO — **CICS/VS Logic and Debugging.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024.

SEPTEMBER 4, NEW YORK — **CICS/VS Application Programming — Macro Level.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024. Also be-

ing held Sept. 6, 9, 11 and 13 in New York and Sept. 9-13 in San Antonio.

SEPTEMBER 4-6, LOS ANGELES — **Information Systems Architecture.** Contact: Software Institute of America, Inc., 8 Windsor St., Andover, Mass. 01810.

SEPTEMBER 5-6, CHICAGO — **Recovery/Restart.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024.

SEPTEMBER 5-7, SAN FRANCISCO — **Third Personal Computer Faire.** Contact: Computer Faire, Inc., 181 Wells Ave., Newton, Mass. 02159.

WEEK OF SEPTEMBER 8

SEPTEMBER 8-11, CAMBRIDGE, MASS. — **1985 Society of Manufac-**

turing Engineers (SME) World Congress on the Human Aspects of Automation. Contact: SME, P.O. Box 930, One SME Drive, Dearborn, Mich. 48121.

SEPTEMBER 8-12, BOSTON — **Managing the Explosion; End-User Computing and Emerging Technologies.** Contact: Kimberly Gandia, Society for Information Management, Suite 600, 111 E. Wacker Drive, Chicago, Ill. 60601.

SEPTEMBER 9-10, ATLANTA — **Principles of Prototyping.** Contact: Association for Systems Management, 24587 Bagley Road, Cleveland, Ohio 44138.

SEPTEMBER 9-11, VANCOUVER, B.C. — **International Communications and Computer Exhibition.** Contact: Traccon Exhibitions, 202-535 W. 10th Ave., Vancouver, B.C., Canada V5Z 1K9.

SEPTEMBER 9-11, WASHINGTON, D.C. — **The Data Entry Management Association's (Dema) Ninth Annual Data Entry Management Conference and Exhibition.** Contact: Marilyn S. Bodek, Dema, P.O. Box 16711, Stamford, Conn. 06906.

SEPTEMBER 9-11, WASHINGTON, D.C. — **Federal Computer Conference.** Contact: Federal Computer Conference, P.O. Box N, Wayland, Mass. 01778.

SEPTEMBER 9-12, LOS ANGELES — **CICS/VS MRO/ISC.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024.

SEPTEMBER 9-12, MONTREAL — **First International Conference on Computer-Aided Technologies.** Contact: Stephen J. Leahey, P.O. Box 577, Desjardins Postal Station, Montreal, Que., Canada H5B 1B7.

SEPTEMBER 9-12, SAN ANTONIO — **CICS/VS Application Design.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024.

SEPTEMBER 9-13, ATLANTA — **CICS/VS Internals.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024.

SEPTEMBER 9-13, CHICAGO — **CICS/VS Application Programming — Command Level.** Contact: On-Line Software International, Inc., Fort Lee Executive Park, Two Executive Drive, Fort Lee, N.J. 07024.

SEPTEMBER 9-13, CHICAGO — **Structured Analysis and Design Techniques Workshop.** Contact: Elise Rabalais, Learmonth & Burchett Management Systems, Inc., Suite 405, 2800 N. Loop W., Houston, Texas 77092.

SEPTEMBER 9-13, HOUSTON — **Data Base Development Workshop.** Contact: Elise Rabalais, Learmonth & Burchett Management Systems, Inc., Suite 405, 2800 N. Loop W., Houston, Texas 77092.

SEPTEMBER 9-13, TORONTO — **Basic Systems Analysis.** Contact: Thomas J. Bisacchino, Association for Systems Management, 24587 Bagley Road, Cleveland, Ohio 44138.

SEPTEMBER 9-13, WHISTLER MOUNTAIN, B.C. — **The Ninth Data Communications Symposium.** Contact: William Lidinsky, Bell Laboratories, Room 6B309, Naperville-Wheaton Road, Naperville, Ill. 60566.

SEPTEMBER 10-13, MELBOURNE, AUSTRALIA — **The First Pan Pacific Computer Conference.** Contact: The Australian Computer Society, P.O. Box 212, Hampton, Vic. 3188, Australia.

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Open Access on a PRO?

MS FORTRAN on a VAX?

Condor on an MV/10000?

Multiplan on a PDP-11?

WordStar on a VAX?

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PertMaster on a PRO?

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QuickCode on a PDP-11?

DISC-DBL on a VAX?

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WordStar on a PDP-11?

Spellbinder on an Eclipse?

Friday! on a VAX?

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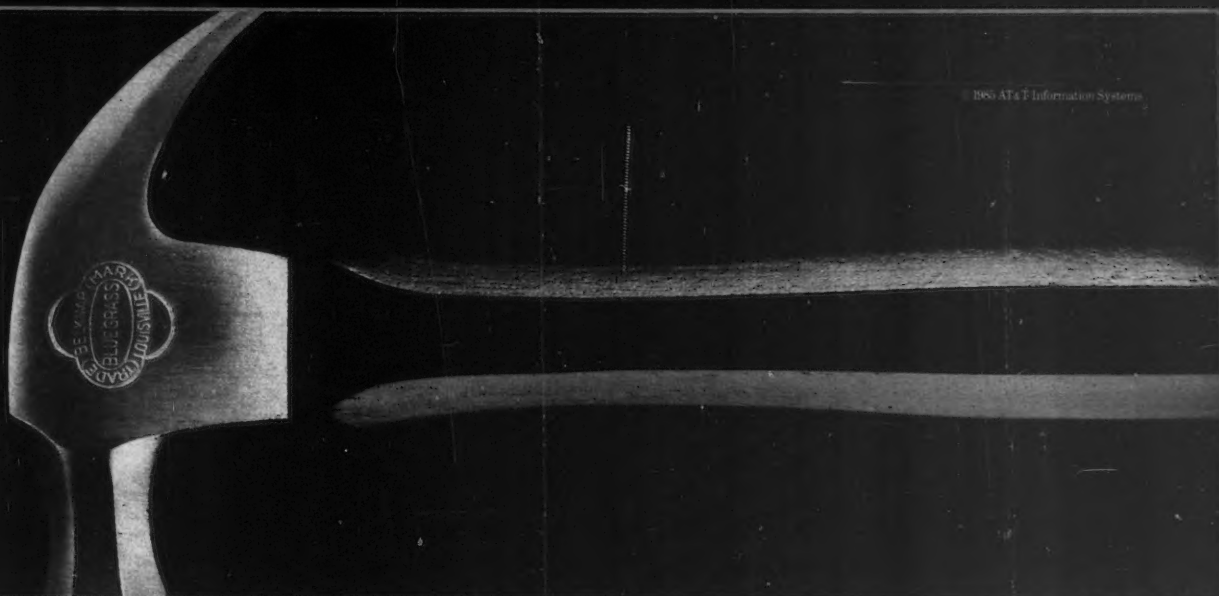
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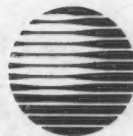
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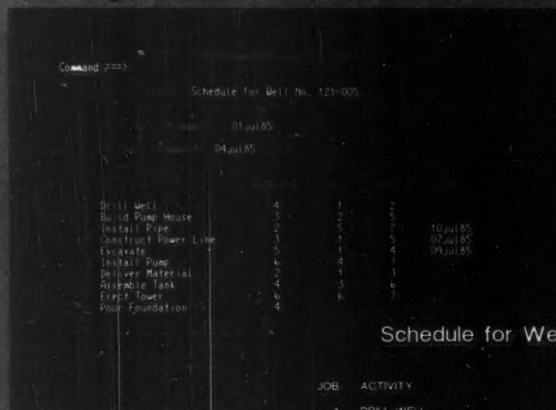
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EDITORIAL

Mini vendors poise for change

Recent financial reports dramatically prove that, with a few exceptions, minicomputer vendors are shouldering the brunt of the sudden decline in computer equipment sales. If the slump extends beyond this year, the minicomputer industry may find itself undergoing a drastic restructuring rivaling the infamous microcomputer shakeout.

The mini vendors, meanwhile, are betting that the situation is a mere cyclical correction that will run its course by the end of the year. But that is just what semiconductor manufacturers were saying at this point last year, and just recently, two of their number — Intel Corp. and Texas Instruments, Inc. — warned that the chip industry is in its worst recession since 1974, with no end in sight.

The problems of mini vendors Data General Corp. and Wang Laboratories, Inc., which seem to be spreading to other vendors, probably do not quite parallel those of either the chip manufacturers or micro vendors.

In the personal computer wars, history proved that it was suicidal for vendors to ignore standards — witness Gavilan Computer Corp. and Otrona Advanced Systems, Inc. But it also proved that mere adoption of a standard was insufficient to guarantee success.

In the chip industry, commodity pricing and excess capacity acted as pincers when helter-skelter demand suddenly dried up, and customers found they had more than enough products to absorb.

Where once DEC had the dominant role in scientific and engineering applications and where Wang was king of the office typing pool, now there is competition from IBM on one side and a host of commodity manufacturers on the other.

The alternative to emulating DEC and IBM seems to promise pitfalls that mirror the woes of the chip industry. There is a host of firms offering similar versions of minicomputers using Motorola 68000 series microprocessors and AT&T's Unix operating system.

As such systems proliferate, users can pretty much base their shopping decisions solely on price, with the result that the vendors sell into a commodity market that cannot support more than a few low-cost producers.

Unlike the Personal Computer look-alike industry, minicomputer vendors have not been sitting still. DG was able to grab market share with its MV/10000. DEC hopes to regain momentum with the VAX 8600 on one end and the Microvax II on the other. Some younger companies are betting that the relatively middle-aged mini vendors are too big and cumbersome to catch the next wave of technology. With the arrival of Alliant and Encore and others comes a variety of multiprocessing and parallel processing alternatives that promise to offer solutions that can't be filled by general-purpose machines.

It seems that the mini industry is poised at the trunk of three branching alternatives. Will users select the commodity option that seems certain to wreak savage disruption; will they stick with the tried-and-true vendors and continue to press for greater communication with IBM mainframes; or will they bet on upstarts promising breakthroughs?

One year ago, we would have thought there would be time and money to provide some co-existence of the alternatives. Today, it seems that economic factors are forcing vendors into a make-or-break situation. If the sales slump continues, a severe shake-up seems inevitable, particularly if worried users decide that IBM provides the most stable choice.

Jim Kirtz
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LETTERS

Certification for professional pride

In response to your article "Hiring execs don't see ICCP certification as critical asset" [CW, June 24], the writer forgot to mention how nonexecutive data processors feel about certification. Certification is a personal achievement for most professionals.

Our field, although no longer in its infancy, is still trying to carve out a place among the professions. Accountants, engineers, doctors, nurses, lawyers, teachers, insurance agents, to name a few, can be certified in some fashion, and most require further education to be certified. In some cases, their certification is a requirement for employment; in other cases, it is a title that goes with professional pride.

By 1990, surveys report that there will be a

work force of 500,000 analysts in the DP profession. Currently, there are approximately 300,000 analysts of which 30,000, or 10%, are certified. The Certificate for Systems Professionals (CSP), first to require recertification, has approximately 7,000 holders.

Those in the industry have indicated that recertification through continued education keeps the profession up-to-date.

The CSP is a step in that direction. All CSP holders are required to have 120 hours of continuing education during a three-year period to retain their certificate. Soon, the remaining types of DP certification will follow suit.

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VIEWPOINT

Where are the emperor's new clothes?



**WOHL STREET
MINIJOURNAL**
Amy Wohl

You remember the parable of the emperor's new clothes: Dishonest tailors clothed the emperor in invisible garments and cunningly convinced him they were of the finest and sheerest cloth. The naked emperor paraded through the streets of his kingdom and none — save a very honest young lad — dared tell the truth.

But what does it mean when the emperor insists he is naked, while his courtiers and scribes insist they see his new clothes? For months now, the press has been full of tales of IBM's imminent announcement of a personal computer. "Any day now," stories say, "here is what it looks like," they proclaim. "Wrong time to buy old stuff."

And there's the problem. Suddenly, personal computer sales, IBM's and others, seemed to slip. Especially skittish were the big users. Who wants to get stuck with a thousand slightly out-of-date new machines?

Enter IBM. "Stop the rumors," they say. "There is no PC2. So don't sit around waiting for an imaginary machine to appear, buy some Personal Computers today." Well...

Let's look at the facts. IBM's Personal Computer is not exactly a new product. In fact, it is not a product at all but rather a family of products, more or less compatible, embodying a range of related technologies and capable of significant and continuing enhancement before a noncompatible machine would have to occur.

And there are marketplace facts to consider. No one, no matter how much technology they have stuffed into a microcomputer product, has success-

fully outrun IBM since its announcement of the original Personal Computer in 1981. They can try to be bigger, smarter, faster or more exciting, but users will still want it to be Personal Computer compatible. The more they buy Personal Computers, the more they need to care about the compatibility of new products with their growing installed base.

So IBM holds most of the cards. As long as it doesn't change the rules of the game by creating a new machine with new kinds of compatibilities, it is unlikely that any noncompatible challenger can pose a serious threat.

IBM customers greeting PC2 with open arms?

IBM has to worry about how a PC2 would be received by customers. Big buyers of the Personal Computer would scarcely greet the announcement of a noncompatible machine, however dazzling, with open arms. So even IBM will be constrained in its eventual announcement of a less compatible, newer technology product. Clearly it will have to offer hooks back into the older environment and the giant installed base that the Personal Computer's success has created.

IBM is, of course, technically correct in its recent PC2 comments to the press and the industry.

■ There is no PC2. That is, whatever IBM is going to call the machine, it's not going to be PC2. Nor is PC2 a current internal code name for any IBM product. IBM always calls potential products by much more exotic names — like mountain ranges or wild animals.

■ There is no PC2. That is, IBM has not yet selected the product that will replace or extend its current Personal Computer product line from among a number of contenders being developed, tested and politicked within IBM.

IBM normally looks at a number of possible products before making a major decision — four or five products for the original Personal Computer, for instance. The rich set of features you've probably glimpsed in articles about PC2 are a direct result of this IBM strategy. The press has actually

fallen over four or five different products but has talked about them as if they were a single "super product," a real competition killer.

If IBM is going to continue to be in the personal computer business, eventually it must choose a product for the next major, but not necessarily the next, Personal Computer announcement. That is, there could be a further extension of the current family before IBM finally moves up to new, more powerful and different technology.

■ There is no PC2. That is, IBM can't abandon its current customers who have so enthusiastically bought the current generation of IBM Personal Computers. Anything that IBM announces from now on will require some compatibility with its installed base. This, in itself, will allow IBM to deny forever that anything is a PC2, since if it's compatible at any level with the current product it can, with justification, be called an extension of the current product and not a new product at all.

■ There is no PC2. That is, as long as IBM has lots of Personal Computers in inventory, it won't want to announce a new product and substantially reduce the value of existing assets. So if there are lots of Personal Computers still around, you can bet that IBM will try to sell them off first. If that doesn't work, it can always hold the fire sale later.

Of course the other personal computer vendors — everyone in the industry except IBM and possibly Apple, since they aren't trying to be particularly Personal Computer-compatible anyway — aren't very happy about all this. They need time to plan if they're going to be competitive and compatible with whatever IBM decides to do next. Their efforts to discover something substantive about IBM's activities is what fuels the furor.

Too bad. Short of a leak from within IBM (unlikely), based on an already-made decision of what to announce next (less likely), the competitors have to wait. And so will you, gentle user. But take heart. All things happen eventually. And you're probably not ready for all that new technology yet anyway. If you are, you know what to do. Tell the emperor you'd like to be invited to a fashion show.

Wohl is president of Wohl Associates in Bala-Cynwyd, Pa., and editor of the "The Wohl Report on End-User Computing" newsletter.

Three-phase approach to converting business users



HUMAN CONNECTION
Jack Stone

The press recently reported on a survey by Software Access, based in Mountain View, Calif., of U.S. households and their personal computer use. Based on the results, its president, W. L. Coggsall, was quoted as saying that "the preponderance of Americans cannot imagine any way they could use a personal computer, either at home or at work."

This conclusion should hardly come as a surprise to most data center managers who have struggled long and hard to convert even a tiny number of business folks to truly effective DP users and who know the uphill battle they face in extending this meager success to the rest of the population.

One data processing manager who has endured his share of frustration

with user training has a novel approach to it:

"We tend to forget that the perspectives — and the expectations — of the vast majority of business users of computing equipment, be it mainframe, mini or micro, derive from appliance-class electronics, [for example], machines designed for acceptance by the broadest range of consumers.

"Until our systems can be packaged in a similar manner, the large percentage of users will continually rebel against them. 'After all,' they proclaim, 'to install our stereo and video equipment, we didn't have to spend a week in a classroom, study audiovisual tapes, read 400-page manuals — and we absolutely didn't need to fool around with an operating system.'

"The point is that the public expects a complex machine to be one that nevertheless plugs in and operates after only a brief bout with an installation manual — a situation that is a far cry from what we offer our users.

"But there is a second point to make that is not fully appreciated: the average citizen, after a successful break-in period with a new machine, routinely examines ways of optimiz-

ing performance, be it twiddling knobs on a stereo system or adjusting the height of the rug attachment on a vacuum cleaner.

"Obviously, the industry will not — and probably cannot — change its arcane ways in the short range. So we have to look for other solutions. One notion is a three-phase approach to bringing the users up to the point where they will embrace mainframe operations with open arms.

"The first phase involves the use of a low-cost, appliance-style computer for basic computer training, one that satisfies, or at least comes much closer to satisfying, the needs of typical neophyte users.

Information products without hassle

"Most important, it must provide immediate information products of significance and do so without any substantial hassle, particularly extensive training, or a need to understand an operating system.

"Then, banking on their demonstrated willingness to adapt and grow, in phase two I would expect to wean the users off the appliance onto a personal computer.

"Now this will only work after the staff develops reliable applications, based on proven, well-established

software packages and loaded with automatic operating system procedures and keyboard macros so that the users can focus on data to be processed and the output results, instead of systems internals — which is the whole point of information systems in the first place.

"If this second phase of development goes well, then they would be ready for phase three, a transition to mainframe operations with all the technical eccentricities attendant thereto.

"For us, systems for phases two [IBM-compatible personal computer] and three [the mainframe] are in place, and recently I've found a system for phase one that seems promising. I'm looking at the Kyocera-class portable machine, like the [Tandy Corp.] TRS 100/200 and NEC Corp. 8201A.

"Most important, recently released packaged software from independent vendors has provided some simple but valid functionality — perfect for immediate, though elementary, production — and a complementary, easy-to-learn and [easy-to-use] processing capability for an IBM-compatible machine to handle files uploaded from the Kyocera."

Stone is a Washington, D.C.-based independent management consultant, educator and writer, specializing in DP human communications and personnel development.



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COMPUTERWORLD

Update

August 5, 1985

The Paper Chase:
Trends in Printer Technologies



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IBM Personal Printers...The Finishing Touch

Update

Getting serious about printers

By Glenn Rifkin
Update Editor

The impact side

"In the printer business, there are no revolutions, just evolutions," states Peter Steiner, an analyst with Dataquest, Inc. in San Jose, Calif.

This statement explains, more than anything, the staying power of impact printing, a technology that was expected to get swept aside by the crashing waves of nonimpact machines. Though the new technologies such as lasers, ink jets, thermal transfer, magnetography and ion deposition grab the headlines, impact printers still generate the sales.

"The idea that nonimpact will rule the world and eradicate all impact technologies in the next five years has been suggested. But to our way of thinking, that is not going to happen," declares Jonathan Dower, vice-president of Datek.

"We show that by 1989, nonimpact printing will constitute only 25% of all revenue. It is currently just 9% or 10%," Dower says.

Though the trade press and industry consultants have embraced nonimpact technology with a passion, "in truth, the market has not really received it well," Dower says.

Industry watchers offer many explanations for why the nonimpact fire has not burned brighter, but it generally comes down to a basic tenet: Change does not come easily. It

Among the early driving forces of office automation and business computing was the promise of an end to the mountains of paper that rose higher and higher with the birth of the information age. The promise, however, appears empty. "The paperless office will arrive," the saying goes, "the same day as the paperless bathroom."

Indeed, despite the sophistication of electronic transmission and the ubiquity of the desktop terminal, the desire for hard copy is, if anything, on the rise. For the printer industry, that spells good news. Soaring growth rates are predicted for the next five years and beyond. According to International Data Corp. in Framingham, Mass., total industry revenue should jump from \$7.3 billion in 1985 to nearly \$13 billion in 1989. The number of units shipped is predicted to increase from 6.4 billion this year to more than 15 billion in four years — growth that is driven by the personal computer.

The allure of the market has drawn such heavyweights as IBM, Digital Equipment Corp., Hewlett-Packard Co., Burroughs Corp. and Texas Instruments, Inc. Traditional printer makers such as Xerox Corp., Dataproducts Corp., Centronics Data Computer Corp. and Printronix, Inc. are gearing up to try and hold market share while fighting off both new U.S. entrants and the powerful Japanese manufacturers.

For the consumer — whether a data processing manager, information worker or home personal computer owner — the burgeoning market has been a mixed blessing. Prices have plummeted for many machines because of increased competition and advances in printing technologies.

Unfortunately, the market has also become ensnared in a maze of confusion. According to Datek Information Services, Inc., a Waltham, Mass., consulting firm, there are nearly 150 companies marketing more than 500 printer models. "It is an industry that now boasts over one dozen distinct printing technologies with print lines ranging in size from 1 inch to 6 feet across," a Datek report says.

For the seller, the slice of the market pie is becoming tougher to acquire; and for the buyer, the purchasing decision on a printer has become increasingly complex.

The printer market is split into two key factions: impact and nonimpact technologies. Impact, which is an outgrowth of basic typewriter technology, encompasses any printer mechanism in which the blank page is struck by some print-head device. Nonimpact covers a growing parade of technologies in which the printing device does not come in contact with the page.

For the DP staff, the printer has become yet another key item on the high-tech shopping list, and both impact and nonimpact vendors are taking great pains to state their cases.

This section of *Computerworld* Update will explore the various components of the printer industry and assist the DP professional in making the proper purchasing decision.

Among the areas of focus are impact vs. nonimpact printing — the merits and demerits of both; the Japanese impact on the U.S. market; cost justifying the printer; IBM's influence on the market; a look at the software and controllers in sophisticated new machines; and new technologies — what does the future hold?



feature as recognizable as the hum of the mainframes. Though belt, chain, train and drum printers are all under the line printer umbrella, the band printer is the most popular of the DP center line printers. It is an entrenched mechanism that has withstood the test of time.

Capable of operating at speeds of between 400 and 3,600 line/min, band printers are known for their seeming invincibility. They chatter on hour after hour, day after day, year after year, turning out page upon page without missing a beat — and virtually never need repair. In a life of unexpected disasters and constant crises, the DP manager will not

See PRINT UPDATE/4

VALUE U.S. COMPUTER PRINTER SHIPMENTS, 1985-1989 (By printer type)

	1985	1986	1987	1988	1989
Impact					
Serial Matrix	\$2,929,374	\$3,688,884	\$4,350,991	\$5,006,483	\$5,569,997
Serial Character	1,386,563	1,386,878	1,377,699	1,246,155	1,124,090
Line Matrix	266,187	320,108	368,543	419,383	472,347
Line Character	1,292,374	1,416,091	1,511,926	1,601,230	1,662,299
Total Impact	5,874,498	6,811,961	7,609,159	8,273,251	8,828,733
Nonimpact					
Serial	393,169	660,787	844,691	1,036,477	1,270,089
Page Subtotal	1,180,790	1,497,940	1,719,950	2,116,050	2,649,170
Total Nonimpact	1,573,959	2,158,727	2,564,641	3,152,527	3,919,259
Total Value	7,448,457	8,970,688	10,173,800	11,425,778	12,747,992

Source: International Data Corp.

is not uncommon, for example, to find old drum printers, now considered a dinosaur among printers, hard at work in data centers.

In the multibillion dollar printer business, the role of impact printers varies according to market segmentation, but at virtually every level,

the impact side continues to dominate.

The high end

In the centralized data center, the steady clattering of the workhorse — the fully formed character line printer — has become an ambient

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COVER ILLUSTRATION BY KAREN WATSON

Update

PRINT from UPDATE/3

be easily convinced to part with this trusted printing machine.

"Just like with drum printers, there are lots of people out there committed to line printers, and you'll have to plead a tough case to get someone to switch to nonimpact," Dower says.

Another factor contributing to the staying power of line printers is again pragmatic: carbon-based multiple part forms. Regardless of the sophistication of electrophotographic nonimpact printing, those machines, by design, cannot strike the page and are therefore incapable of creating the multiple part forms that the billing, invoicing and accounts receivable departments require for their record keeping. Companies that print W2 forms, stock certificates, mass mailing cards and legal documents will continue to use impact printers. Until that requirement

Big Blue's introductions perceptibly brightened the prospects of the other major players in the impact game. Dataproducts, the Woodland Hills, Calif., printer manufacturer, has long dominated the line printer business as a supplier to OEMs and value-added remarketers. For Irving Weisman, Dataproduct's vice-president of technology assessment, IBM's imprimatur "is saying this is important, and the market will be around for a while."

For Dataproducts, the timing couldn't be better. In order to remain a leader in the printer business, the company has begun exploring new avenues and markets. It recently introduced its first nonimpact

printer, the LVR 2600 26 page/min laser with a Toshiba, Ltd. engine. It has also entered the retail market selling printers under its own label. But the company's bread and butter continues to be its sales of impact printers to OEMs like DEC, Wang Laboratories, Inc. and Prime Computer, Inc.

"The strength of our company is the friction-free flex hammer mechanism that is the heart of all our impact printers," Weisman says. "They don't need maintenance, and they go on forever."

Weisman indicated that Dataproducts is soon to announce a new version of the hammer mechanism that will be part of a new band printer designed to replace its now aging B series. Acknowledging that

nonimpact will make inroads into the impact world, the company plans to offer more new nonimpact machines. "But we're still very committed to the impact world and plan to be there a long time," Weisman says. "Impact will still be dominant."

Ironically, it is the very quality and reliability of the high-end band printers that has caused the market to stagnate. Having an installed base of machines that "go on forever" and are by now fully paid for, the DP manager is not in any hurry to make a change. As Dower points out, the buying decision for many is a non-decision.

"People tend to not make any decision," he explains. "They just stick with what they have."

See PRINT UPDATE/6



Dower

changes, the impact printer will remain a viable business product.

Though the market for impact line printers is relatively flat, it continues to generate in excess of \$1 billion annually in sales. And in the past few years, when consultants were ready to declare the technology moribund, vendors such as IBM, Dataproducts, Centronics and Cynthia Peripheral Corp. responded by turning out new products that brightened the picture considerably.

IBM introduced its 4248 band printer in 1984, and the 3,600 line/min machine quickly became the Cadillac of the market. Earlier this year, IBM reconfirmed its commitment to the technology by unveiling its 4245 band printers (Models 12 and 20), which are capable of 1,200 and 2,000 line/min respectively. At that introduction, IBM also announced 25% price reductions on its high-end line of band printers and 12-month warranties on both the 4248 and 4245.

According to Jack Smulovitz, IBM's planning manager for impact printer product development, the warranty is significant as "a statement of the quality of the box" (see story Update/18).

As Dower points out, IBM's offerings are, from a cost/performance perspective, "extremely competitive with [nonimpact] page printers."

"IBM has an enormous installed base of line printers," he continues. "If they just went out and sold replacement printers, they could keep themselves in business for years."

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Days two and three are specifically geared for people interested in the Macintosh as a tool for business and anyone else interested in the Mac.

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Here's a look at some of the conference sessions designed for you:

- The Outlook for the Mac in the Office
- Developing Software for the Macintosh
- How to Start and Survive in Business with a Macintosh
- Maximizing MacPaint®
- The Mac Clinic
- A Guide to Better Business Graphics
- Maximizing MacWrite®
- Database Management on the Macintosh
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- File Management Tips and Techniques
- Maximizing Macintosh Disk Storage
- The Mac in the Classroom
- The Mac in Higher Education
- Developing University Courseware with a Macintosh

Update

Japanese companies making waves in U.S. printer mart

By Peter M. Steiner
Special to CW†

Like the automobile, home appliance, wristwatch and audio/video markets, the U.S. electronic printer market has undergone dramatic changes as a result of products imported from Japan.

Usually the most discussed subject concerning Japanese products is price. In the lower speed segments of

today's printer market, price is a key factor, but a broader scope is required to understand Japan's true impact.

Both the dot matrix segment and fully formed (daisywheel) segment of the serial printer market were established and dominated by U.S. manufacturers, including Centronics Data Corp., Diablo Systems, Inc. and Qume Corp. The first real Japanese market impact came in the serial dot matrix arena in the 80 char./sec. to 100 char./sec. speed range.

It is true that pricing did give Epson America, Inc. and Okidata Corp. an advantage, but the real

struggle was for volume and market share. Volume is extremely important to Japan's "just-in-time" manufacturing technique as well as to its "full quality control" approach.

A factor that contributed to the Japanese companies' successful sales penetration was the establishment of excellent marketing organizations. The truly successful companies invested heavily in marketing groups that are clearly the pride of the industry.

As more Japanese companies entered the dot matrix market, each was driven by the same basic equation: market share equals volume

sales equals lower production costs. Thus, the early market leaders found themselves in a pricing/margin squeeze.

To escape this situation, more features and functions were added to the printers to maintain price levels. This cycle continues today with the net result being more performance for the dollar.

The daisywheel market segment followed the same pattern as the dot matrix segment, although it took much longer for Japanese companies to become a significant factor. Once they did, however, they made their presence felt. Japanese companies fully dominate the low-cost, low-speed — under 20-char./sec. — segment of the daisywheel market. Japanese companies had an 86% share in that market segment during 1984. The fact that the Japanese hold

computer show the Macintosh™

Here are some of the companies who will be showing Macintosh products:

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First Byte, Inc.	Paradise Systems, Inc.
Forethought, Inc.	PBI, Inc.
Frontrunner Computer Industries	Peripheral Computers & Supplies
Future Design Software	Peripheral Systems
General Computer Company	Personal Computer Peripherals
Haba Systems	Prometheus Products, Inc.
Hayden Book Company	ProVUE Development Corp.
Hayden Software	Queue, Inc.
	Scott, Foresman & Co.
	Servidyne Micro Systems, Inc.



Sierra Information Systems
Silicon Beach Software
Small Business Computers of New England
SoftTech Microsystems
Softidea
Software Arts, Inc.
SoftWeave
Softworks Limited
Stoneware
Sunol Systems
Systems Control
Tecmar, Inc.
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**MACWORLD
EXPOSITION
BOSTON**



Steiner

74% of the serial printer market has drawn a response from several U.S. companies. Some manufacturers have moved to special niches, and others moved to offshore manufacturing, either for subassemblies or for complete machines.

The most notable response came from Hewlett-Packard Co., which introduced its extremely successful ink-jet printer, the Thinkjet. Designed to be a quiet replacement for dot matrix printers, it found immediate market acceptance.

The unique thing about the \$495 HP Thinkjet is the low-cost head ink supply cartridge. Both functions are combined in a throwaway unit costing less than \$10. The serial printer world is still waiting for a competitive response as well as an HP follow-on product. IBM introduced its 200-char./sec. dot matrix Proprinter for \$549. Designed for low-cost manufacturing, this fully featured printer literally snaps together without screws, nuts or washers.

High-resolution impact dot matrix printers were developed more rapidly in Japan to meet the needs of Kanji, the Japanese alphabet. This created the argument over whether 18-pin heads or 24-pin heads were best suited for near-letter-quality printing in the U.S.

The real answer was once again keyed to volume production requirements. Character sets were digitized to take advantage of the 24-pin design so that both the Far Eastern and

See JAPAN UPDATE/22

Update

PRINT from UPDATE/4

That's why drum printers, which everyone knows is an archaic technology, are still around.

"Line printers have a remarkable life history, and 20 years is nothing; they still run fine.

"In the DP site, people tend to buy new systems but don't get new printers, which is why the market

moves more slowly than anyone suspects."

The middle ground

While band printers hold up the high end of the impact market, dot matrix line printers have sparked considerable interest in the middle ground, with speeds from 300 to 900 line/min. In fact, though growth in the band printer market remains flat, matrix line printers have ex-

perienced strong growth (up to 25% annually, according to Datek) in the past few years. Nonetheless, it remains a relatively small market.

Traditionally targeted to such special applications as bar coding and labeling, matrix line printers have picked up speed in recent years and now offer

several advantages over band printers. Like serial dot matrix printers, they can handle graphics and color.

This ability, according to industry analysts, is becoming a major requirement for DP shops. "A DP manager now has a choice when it comes to graphics," Dataquest's Steiner says.

"He can use the line dot matrix, which has fairly good speed and will serve

both his line printer requirements as well as some imaging requirements, or he can look to digitized imaging using lasers."

If speed is not as critical as flexibility, line dot matrix printers can be an economical choice for the DP manager.

Such vendors as Printronix, HP, IBM, Mannesmann-Tally, Inc. and Genicom Corp. offer 300 to 600 line/min machines for under \$8,000. If speed is an issue, HP offers its 2566 matrix printer; reportedly running at 900 line/min — the fastest matrix on the market. But it costs \$21,500.

According to Chuck Ulfers, HP's marketing man-

SCIENCE/SCOPE

In a historic milestone, a prototype high frequency hopping radio system has been tested successfully over several complex communications paths that were not restricted to line of sight. Frequency hopping techniques have been previously used only in the VHF and UHF portion of the radio spectrum to enhance the antijam capabilities of tactical and strategic military communications systems. The recent tests, conducted by Hughes Aircraft Company engineers under contract to the U.S. Army, covered the high frequency range from 2 to 30 MHz. They showed that antijam communications are now possible over great ranges without line-of-sight paths, which require repeater stations or satellite relays. Hughes is developing the system, called Short Term Anti-Jam (STAJ), as a retrofit enhancement kit to its existing line of U.S. military standard high frequency tactical radios.

High-energy laser pointing and tracking systems are among the advanced electro-optical systems supported by the Albuquerque Engineering Center in New Mexico. The center's scientific disciplines include physics, optics, mathematics, lasers, image processing, electro-optical control systems, and computer science. Programs involve electro-optical sensors for strategic military applications, including work performed at the U.S. Air Force Weapons Laboratory at Kirtland Air Force Base and the White Sands Missile Range. The Hughes center is expected to expand from its current staff of 42 highly trained professionals to greater than 100 over the next three years.

Complex microelectronics will be produced faster and better in a "paperless" factory in which computers instantly collect data and process work instructions. A new 71,000-square-foot facility at Hughes in Tucson, Arizona, will make complex custom hybrids—historically a major manufacturing challenge—for advanced missiles. The heart of the facility is a computer that ties into business and CAD/CAM (computer-aided design/computer-aided manufacturing) computers and scores of terminals at work stations. Labor requirements will be cut by up to 60%.

An upgraded weapon system and other improvements will help the F-14 Tomcat fighter deter and cope with threats for several decades. Designated the F-14D, the U.S. Navy aircraft will be equipped with an advanced digital radar, new engines, advanced avionics, and the capability for launching Hughes AIM-120 Amraam and AIM-54C Phoenix missiles, as well as the latest versions of Sparrow and Sidewinder missiles. The AN/APG-71 radar will include a fully programmable signal processor and companion radar data processor. These units will provide digital capabilities, as well as digital radar displays, advanced electronic counter-countermeasures, and improvements in the aircraft's detection and tracking range and accuracy. Hughes will provide the upgraded APG-71 under contract to Grumman Aerospace Corp., prime contractor on the Navy F-14 improvement program.

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'Now we're at a midway point, and interest is growing in print quality and flexibility.'

— Chuck Ulfers
Hewlett-Packard Co.

ager for system printers, the matrix line printers provide a good, heavy-duty solution with the capability to run 16 to 20 hours per day.

"Customers' major concern used to be cost of ownership," Ulfers says. "They didn't think much about print quality. Now we're at a sort of midway point, and interest is growing in print quality and flexibility."

On the down side, matrix line printers may be a niche that has nowhere to go. Despite its growth, the market is small and is being nipped at from several sides. High-speed serial dot matrix printers, capable of speeds of up to 300 char./sec., are grabbing for market share at the low end, but consultants concede that even though technological breakthroughs may allow even greater speeds for matrix line printers, by the time it happens users may have already switched to nonimpact page printers.

Speed information is also misleading. Though a company may tout its printer as running at 600 line/min, it has variable speeds, and for such applications as graphics it may operate at considerably slower speeds.

The low end

For the DP/MIS manager, the issue of decentralized, distributed processing remains a priority today. Though not the most critical concern, peripherals are vital to the organization.

The influx of personal computers and workstations among Fortune 1,000 firms

See PRINT UPDATE/7

HUGHES

Update

U.S. COMPUTER PRINTER
SHIPMENTS, 1985-1989 (% by printer type)

	1985	1986	1987	1988	1989
Impact					
Serial Matrix	66.8%	67.5%	67.7%	68.7%	68.2%
Serial Character	19.0%	15.6%	13.2%	10.1%	7.8%
Line Matrix	0.7%	0.6%	0.6%	0.6%	0.5%
Line Character	1.3%	1.0%	0.9%	0.7%	0.7%
Total Impact	87.8%	84.7%	82.4%	80.1%	77.2%
Nonimpact					
Serial (thermal, ink-jet, transfer)	10.6%	13.3%	15.4%	17.6%	20.0%
Page	1.5%	1.9%	2.2%	2.4%	2.8%
Total Nonimpact	12.1%	15.2%	17.6%	20.0%	22.8%

Source: International Data Corp.

PRINT from UPDATE/6

has brought with it a concurrent mass of printers. As local-area networks and remote computing become more prevalent, the hard-copy wish list of the information worker will fall on the MIS manager's desk.

Although nonimpact vendors are touting their page printers as the perfect shared resource in the office, the serial dot matrix continues to be "the bread and butter of the industry," according to Maureen McManus, manager of the printer market program for IDC. With the personal computer driving the low end, dot matrix printers are the leading printer product sold. Though the 1984 numbers differed — Datek estimated 3.6 million units shipped, IDC put the figure at 2.5 million — it is clearly a massive market.

Also experiencing continued high interest on the impact side are serial fully formed character (or daisy-wheel) printers. According to Datek, daisywheel printers accounted for 1.1 million units and \$1.6 billion in sales in 1984, making it the second largest market area for printers.

For the DP/MIS manager, as well as the individual buyer, this market is crowded and confusing. IDC estimated that more than 150 vendors are selling either serial dot matrix or daisywheel — or both — printers. Though many companies are simply buying a printer on an OEM basis and slapping their names on the box, some significant vendors are jumping seriously into the market. IBM, which until this year had simply been the OEM for Epson America, Inc. printers, now has entered the market with its own \$549 Pro-printer, a dot matrix machine, and the Wheelwriter, which uses a daisy-wheel.

DEC, which offers a range of impact and nonimpact printers (mostly sourced from the likes of Dataproducts, Xerox, Ricoh Electronics, Inc. and Tokyo Electric Co.) has recently announced its LA210 office printer. This model, developed internally and manufactured in Taiwan, is the company's most popular dot matrix printer, according to Suzanne Skinner, base product marketing manager. A redesign of the LA100, the LA210 is compatible with DEC's personal computer line.

Given the volatility of this market, DEC and other computer makers plan to do whatever it takes to grab a

See PRINT UPDATE/10

To get a lot out of your printer, you need a lot of programs, right?

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The Right Printers for the Right Computer Systems

Update

Impact vs. nonimpact: The hard-copy battlefield

Interview

As nonimpact technology gets cheaper and better, how will the impact world fight it off?

Kilcullen: To answer that, you have to go through a few different tiers of price/performance ranges and applications. Starting at the low end, or the personal computer end, of the product line, nonimpact technology is coming forth with serial printers that use thermal transfer technology on one hand or ink-jet technology on the other hand. In the impact arena, we have the low-cost daisywheels and the very low-cost impact dot matrix.

When you look at the four different technologies, the one that I would be most worried about, if I had it in my product line, is the daisywheel, because without graphics it really doesn't provide the utility that people are looking for in the low end of the office environment.

Thermal transfer printers are probably the lowest cost approach, but from a user's standpoint, [they] are relatively limited because of their need to use very smooth, highly finished paper. Certainly in the U.S., where we tend to use a high rag content paper, the print quality is very poor.

The ink-jet is a nice niche product which addresses some color applications, but once again, it won't be super price competitive with impact matrix. Impact matrix has gotten to be very cost competitive and addresses the widest range of potential applications with its graphics capabilities, levels of print quality and levels of throughput. And there is still the need to do multi-part documents.

What about the higher end?

Kilcullen: The applications there are going to be filled by the higher performance daisywheel printers, the higher performance serial matrix printers and the lower cost laser printers. They are the three challengers. The big issue there, I believe, is the total cost of ownership of each.

Please explain.

Kilcullen: When you look at the "consumables" aspect of the [Canon USA] CX-based machines with the operator-replaceable module that replaces, in one operation, the photo receptor, the toner and other aspects of the wear items in the

printer, that is a pretty high ongoing bill. If you look at duty cycles, it can average you \$75 to \$100 a month. And with the complexity of that product, you are going to have service calls, certainly more than one a year. Laser printers traditionally have been very service intensive.

On the other hand, we have made significant strides in the impact matrix printers relative to reliability and cost of ownership. The cost of replacing a ribbon every 45 to 90 days at \$15 apiece is significantly less than replacing the guts of a nonimpact laser printer.

ic technology has not really been established, and it would be a relatively expensive, complex product. **What about at the data center end?**

Kilcullen: Nonimpact printers made their first impact back in the mid-1970s addressing the very, very high-volume print shops with the IBM 3800 and the [Xerox Corp.] 9700. But they went into sites that primarily had very high usage and could almost have justified a field engineer on site because those things go down — they print 18,000 lines a minute — but they are probably down every two

Technology battle lines are not usually as clearly drawn as they are in the world of printers. Impact printers — the entrenched, traditional workhorses of the data center and beyond — are being challenged openly by the various technologies that make up nonimpact printing.

Though impact machines are currently holding their own, the encroachment of the new breed is being felt as prices for nonimpact machines go down and reliability and versatility go up. Pundits on both

shrinking market. I can't believe that IBM would make the investment that they did in the 4248 and the 4245 if they didn't see that they were going to have production adaptation. Let's face it, at that end of the business there is no one that should have a better handle on the user base than they do.

What about the unlimited potential of nonimpact vs. the limits of impact?

Kilcullen: It certainly has become a significant factor. The resolution and the flexibility will allow the nonimpact segment, especially in the mid-range [and] up, to grow and to grow significantly. But it doesn't spell death, doom and disaster for the impact world at the same time. The growth rates probably won't be what we experienced in the past, but there are many applications and many reasons why impact printers will continue on and grow, certainly at a more moderated rate.

What about all the publicity surrounding nonimpact? Is the user just ignoring this?

Kilcullen: I've been in this business for about 15 years, and the first time that top management in the company became alarmed about nonimpact taking over the world was about 1970 or '71 when I was on a joint planning committee to look into those technologies. It's always been the dark cloud hanging over our head. Progress has been made in the nonimpact area, but at the same time, the flexibility and the price/performance point with impact printers has been dramatically affected. You get a lot more bang for your buck with an impact printer today than you did three years ago.

So quietly, while all the publicity has been focused on nonimpact, the impact technology has improved as well?

Kilcullen: Yes. You have graphics, color capability, demand documents, a combination of cut sheet and fanfold paper. Acoustics have been improved, head life has been improved and, not the least of which, the cost has improved. Our lowest cost impact serial printer has a retail price of \$299. Look back three years ago — who would have ever dreamed that you would be able to buy a printer like that for \$299?

Robert Kilcullen



'You get a lot more bang for your buck with an impact printer today than you did three years ago.'

The [mean time between failure] of serial impact matrix printers has improved by orders of magnitude over the last five years.

What about the question of versatility and functionality?

Kilcullen: Serial matrix printers have evolved to address some of the specific needs of a user — addressing, for instance, transaction processing where one wants to get a document printed and immediately available to the user. You have demand document tear-off right after the last printed line. You have the ability to insert a document — for instance, a car rental form — that might have information on it already and it's brought back and you can insert it into a printer, print out the remaining information and get it back.

The ability to handle color, although [that] is handled very nicely by ink jet at the low end. But in the middle range, a cost-effective way of doing it with electrophotograph-

hours. You need somebody around to fix them.

But the 2,000 line/min impact printers were certainly affected by the introduction of those types of products. Once again, the trade-off primarily was reliability. People with that demand tended still to want an impact printer. Plus, certain applications need multipart copies; people still don't necessarily trust magnetic storage. So that still is a need that hasn't been and won't be replaced by nonimpact in the foreseeable future. It is interesting to note that IBM announced, in the last year, five new high-speed impact fully formed character line printers.

Consultants seem to think that when the time comes to replace the old band printers, the DP manager will turn to nonimpact technologies.

Kilcullen: Certainly the growth has flattened out [in the impact printer market], but I don't see it as a

Update

sides have made their predictions about the future of the printer market. Some openly predict a lopsided victory for nonimpact — a complete takeover of the market within 15 years — while others are adamant about the staying power of the impact world.

Other industry observers tend to agree that although growth in impact sales is slowing and nonimpact numbers are growing rapidly, there is a place for both technologies. Applications, not bells and whistles,

will drive the market and users will, as usual, determine their purchases by need, not technology.

Nonetheless, both sides have strong arguments in favor of their respective technologies. *Computerworld* Update Editor Glenn Rifkin interviewed leading proponents for each side of the issue. Representing impact printing is Robert Kilcullen, vice-president of marketing, sales and business management for Centronics Data Computer Corp. of Hudson, N.H. Speaking out for the non-

impact side is James L. Busby, president and chief executive officer of QMS, Inc. in Mobile, Ala.

Centronics, although undergoing internal changes, remains a leading manufacturer of dot matrix and line impact printers for the OEM market. The company was acquired in 1982 by Control Data Corp. Kilcullen joined Centronics in 1977 from CDC where he was responsible for several functions, including product marketing in its printer division. He has 13 years of experience in the area of

computer printers.

QMS, formerly Quality Micro Systems, Inc., is a manufacturer of a series of medium to high-end laser printers with a range of graphics options. Founded in 1977 by Busby, QMS has grown to 300 employees and sales of \$31 million. A native of Mobile, Busby is an inventor, pilot and blue-water angler with degrees in electrical engineering from the University of Alabama and business administration from the University of South Alabama.

Interview

Despite all the publicity surrounding nonimpact printing, the numbers still strongly favor impact. What has to happen to stimulate some growth in this area?

Busby: Initially, laser printers had two basic hang-ups that kept them from successfully competing against impact printers. One was cost; they were much more expensive. The second was reliability because the impact technology was much more reliable.

Over the last year or two, however, you have seen the price of nonimpact printers coming down significantly to the point where Hewlett-Packard introduced the \$3,500 [Laserjet] machine. I believe that pricing on nonimpact printers is going to continue to decline over the next couple of years very significantly, to the point where it will represent extremely strong competition against impact printers.

What about reliability?

Busby: Presently, what you get with nonimpact printers is what you pay for. If you get a Canon U.S.A. LBP-CX-based machine, you get a machine which has a 3,000 page-per-month duty cycle and a life expectancy of something like 100,000 pages.

If you want to pay more money and get something, for example, that is based on a Xerox Corp. XP12 print engine, then you can get a machine that's rated at 15,000 pages per month and has almost an unlimited life expectancy. So the reliability is there if you are willing to pay for it. As time goes on, the reliability is going to go up as the price comes down. We hear talk from some Japanese print engine suppliers that they will be producing in the next year or two some very inexpensive print engines with very high duty cycles.

Nonetheless, the numbers are still heavily weighted in favor of impact.

Busby: We see a much higher level of activity in our marketplace than we saw even a year ago or six months ago. We have every reason to believe that the market is not slowing down and, in fact, is accelerating quite rapidly or is going to over the next some months.

Generally, people are reluctant to change, to give up what they are

used to for a more complex technology. How will the nonimpact world address that?

Busby: That is one of the problems that we recognized early on as being a barrier to getting into the marketplace and the only answer to that is educating the user.

I think it is just a matter of education and a matter of time. We have seen a very quick acceptance of laser printer products in the field.

What will drive this market at the high end, the data center end?

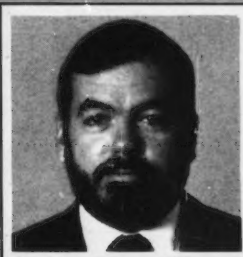
Busby: Having the right application

have no answer in the nonimpact world is the multiple-part forms question.

Busby: There are some applications where you are going to need the impact printers no matter what — for example, where you have multiple forms and very high speeds. The main answer with the nonimpact printer is to be able to print multiple copies in a serial fashion and also to be able to print on both sides of a page.

There are print engines that are coming out relatively quickly, I believe before the end of this year, which will be relatively inexpensive.

James L. Busby



'My opinion is that within five years, 80% to 90% of all printers sold will be nonimpact printers.'

software so that you can just unplug what you were using before and be able to plug this device in and have it do something useful.

Also, having software packages available which utilize the capability of laser printers. Most of the software that is available today is still based on using impact printers of various kinds. So as time goes on, there will be a lot of companies writing software that supports laser printers... and takes advantage of the features and at that point, it will become more cost effective to spend a few extra bucks and get a laser printer.

The band printer market continues to sell well in the data center. What form of nonimpact technology can take on the band printer?

Busby: Certainly not the present state of laser printers because the duty cycles aren't even beginning to approach those of band printers.

Another question that seems to

divide and will be able to print on both sides of the page. If you have a laser printer that is five times faster than a similar impact printer, then certainly you can print five copies one after the next as fast as that printer can print five all at the same time. That is the only solution to that problem.

What you are saying is that you don't really believe that nonimpact will totally transplant impact.

Busby: Not totally.

What do you think the market will shape out to be, say in five to 10 years in terms of impact vs. nonimpact?

Busby: My opinion is that within five years, 80% to 90% of all printers sold will be nonimpact printers. I can see it happening right now.

Impact printers seem to have made their presence felt in the high and low ends but not in the

middle ground. What can we expect there?

Busby: The problem is that there has not been a print engine, a marking engine that addressed the middle of the marketplace. I firmly believe that by the end of this calendar year, there will be more than one print engine — at least two, maybe more than that — that will address that segment of the marketplace with duty cycles as high as 50,000 pages per month and which are relatively inexpensive.

You think that those are going to come from the Japanese?

Busby: Yes. Although I believe Xerox will announce an engine in that area.

What about IBM?

Busby: I think IBM is likely to impact the U.S. market in much the same way with the laser printer that they did with their [Personal Computer]. When IBM announces a relatively low-cost laser printer, the market will really explode. IBM certainly will be the most dominant competitor from the U.S. They may very well beat out the Japanese.

You feel graphics are a key driver for nonimpact technology?

Busby: Exactly. At this point, with impact printing, you typically get somewhere between 5,000 to 10,000 dots to the square inch. With nonimpact printing, you are now getting 90,000-plus dots. With that kind of resolution, you can do not only better text, but you can also do lines and boxes so that you can create people's forms and fill them in all at the same time. You can do people's signatures and put the signature as part of the document; you can even put somebody's picture as part of the data that you send to the printer. The flexibility becomes enormous.

There are hundreds of printer vendors selling hundreds of products using dozens of technologies.

What can the DP manager do to make sense of all this?

Busby: The DP manager just has to continue to keep himself educated because this marketplace is changing so fast. He has to look at what is available and what his needs are. He has to purchase his products based on what he needs to do with those products and not just because it is some sexy new technology. ■

Update

U.S. PRINTER MARKET
SHIPMENTS AND LEADING VENDORS

Printer Type	1983		1986		Top Five Vendors
	Units thousand	Dollars billion	Units million	Dollars billion	
Serial Character	712	\$1.37	2	\$2.40	Diablo Systems, Inc. Qume Corp. NEC Information Systems, Inc. Brother International Corp. Silver-Reed America, Inc.
Serial Dot Matrix	1.86	\$2.28	4.6	\$4.14	Epson America, Inc. C. Itoh Electronics, Inc. Okidata Corp. Star Micronics, Inc. Texas Instruments, Inc.
Serial Nonimpact	132	\$16.2	1.6	\$990	TI Hewlett-Packard Co. Star Micronics Trendcom Okidata
Dot Matrix Line	31	\$318	55	\$510	Printronic, Inc. IBM HP Decision Data Computer Corp. Mannesmann Tally Corp.
Nonimpact Page	5.2	\$222	72	\$990	Canon U.S.A., Inc. Xerox Corp. IBM Ricoh of America Delphax, Inc.
Character Line	86	\$1.13	100	\$1.40	Dataproducts Corp. IBM Teletype Corp. Centronics Data Computer Corp. Data Printer Corp.

Source: Datacube Information Services, Inc.

PRINT from UPDATE/7

share of the pie. John Bernard, a DEC product manager, states, "We'll build internally or buy what we need to be timely in the market."

For the vendors, the issues are becoming clear. The Japanese have controlled the low end of the market since personal computing became popular. Such companies as Epson, C. Itoh Electronics, Inc., Okidata Corp. and Star Micronics Co. have established a strong presence in the U.S. by selling their own machines, and a spate of other Japanese firms have gained a foothold through OEM agreements. The Japanese, in fact, have been entrenched leaders in several different printer categories (see story Update/5).

For the U.S. manufacturers, the decision to compete in this arena is fraught with peril. Industry analysts agree that a shakeout — some say bloodbath — is coming as price erosion cuts deeply into profit margins.

"We've said all along you're going to see mergers, acquisitions and dropouts," Steiner says. "The total available market is saturated at the low end." For the user, however, the choice is more attractive than ever. As prices fall, the products are becoming better and faster.

Fujitsu Ltd., Toshiba and Epson have begun marketing printers using 24-pin printer heads, which provide denser, higher quality output than the standard 18-pin heads.

"The matrix printer has sharpened the advantage of its versatility — that is, its graphics handling and its font quality have been improved at no threat to its low cost, ease of use or volume handling ability," a report from IDC states.

Daisywheel or character printers, another area where the Japanese hold market leadership, continue to show strong growth as well, but this may be the technology most vulnerable to encroachment from nonimpact printers.

Though it provides the least costly letter-quality output, the daisywheel printer, by virtue of its fixed print-head design, is the least flexible technology.

Despite this drawback and the dire warnings, the daisywheel has done quite well. According to

an IDC report, none of the new technologies have been able, thus far, to unseat daisy-wheel printers.

"Led by price cuts and introductions of models priced under \$500, [daisywheel] printer shipments in 1984 were over 70% better than in 1983, growing from 420,000 to over 700,000," the report notes.

This optimism may be temporary, however, and has not stopped the visible palpitations of such U.S. market leaders as Diablo Systems, Inc. and Qume Corp.

Unable to compete with the economies of scale and automated factories of the Japanese, many U.S. firms have taken their manufacturing work off-shore or have spent millions of dollars redesigning their own plants.

For Diablo, a subsidiary of Xerox, the handwriting seems to be on the wall. Roger Kiel, vice-president of the Xerox printing systems division, made it clear that the company is committed to non-

impact technology, an area in which it is a leader. Referring to Diablo, Kiel says, "That business end is becoming less important."

"In terms of shipments of a certain class of printer, say 80 char./sec., we think that marketplace will peak within the next one to three years and will be starting on the downhill side by the end of the decade."

Whichever technology is preferred, the DP/MIS manager will certainly have some decisions to make. Personal computer printers tend to average nearly 1:1 ratios with personal computers, and predictions for future growth remain high.

IDC estimates that there were 5.5 million personal computers on corporate desks in 1984 and expects the figure to grow to 35 million by 1989. This influx is going to have a major impact on shipments of printers for use with business micros.

As the questions of local-area networks, shared data bases, micro-to-mainframe links and communications are answered, the micros will not only connect one to another but will create shared access to peripherals.

As the IDC report points out, "When 150 [personal computer] users all have access to a single [or single group of] printers, it is possible to amortize the cost of a smaller number of more expensive printers — printers with the capability to handle more volume, at higher speeds and with higher quality output."

The nonimpact side

Though nonimpact page printers accounted for less than 1% of all printers shipped in the U.S. in 1984, according to Datek, the technology is clearly generating a great deal of excitement. "Once people see the quality in their hands, there's no turning back," states Charles Pesko, president of C. A. Pesko Associates, Inc., a Marshfield, Mass., consulting firm.

For impact boosters, that is a tune that's been heard before. Predictions of multibillion dollar markets for nonimpact printers were trumpeted in the late '70s and early '80s, but those numbers simply failed to materialize. Most consultants remain cautious about the future of the technology, but both impact and nonimpact supporters are now acknowledging that strong inroads are finally being made. A testament to that fact is the sudden interest in nonimpact technology on the part of traditional impact vendors.

"Nonimpact is definitely cutting into the impact market," IDC's McManus says. "The fastest growth rates are on the nonimpact side in several categories." Sales of page printers are growing at an annual rate of 110%, she says, with serial nonimpact sales growing at 60% to 70%.

Numbers, of course, can be misleading. While one consultant predicts that nonimpact will hold just 25% of the printer market by 1989, another consultant expects that 40% will be non-impact. Those figures, in fact, are more likely to influence vendor decisions than user purchases anyway.

For the DP/MIS manager, there are other considerations, and nonimpact technology has certainly warranted attention. In fact, advances in the technology have started to pay off in ways that can no longer be ignored. Price/performance levels have dropped dramatically for electrophotographic laser printers, and this decline has opened up a new world of in-house printing possibilities that impact machines simply cannot address.

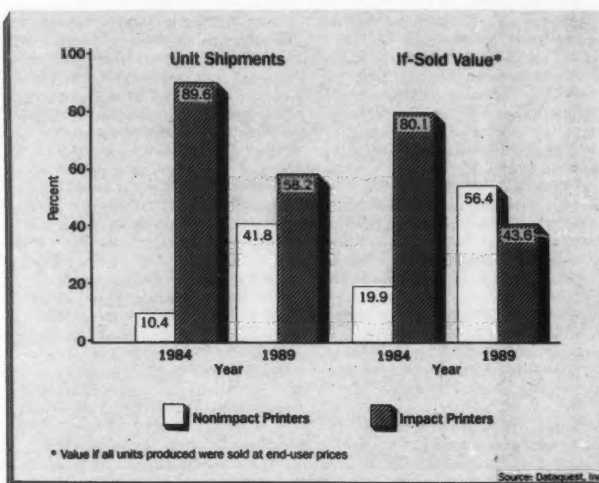
In addition, alternatives to laser printers, which currently hold sway in the market, are cropping up, and a few appear to have long-range possibilities in both general and niche markets.

Using sophisticated software and techniques borrowed from the computer and copier worlds, nonimpact printers are becoming intricate devices capable of speeds and functionality that may well change the nature of hard copy forever.

It is this very complexity that has kept the nonimpact printers from fulfilling their promise.

See PRINT UPDATE/11

THE SHIFT TO NONIMPACT PRINTERS



Update

PRINT from UPDATE/10

Nonimpact printers have gained a reputation for being temperamental, unreliable and expensive. "The DP or office manager hears the click, click, click of the counter on a nonimpact printer and still thinks 'that's 4 cents per page,'" McManus says. "The vendors are working hard to make them simpler, less expensive and more user maintainable."

"There will always be resistance to change," Xerox's Kiel adds. "And somebody always has a real need for doing things the way they used to. But by the end of 1983, one third of the pages printed in large data centers were [printed] on nonimpact machines. And I would suspect that by the end of 1985, that number would approach the 50% level."

From the high end to the low end, nonimpacts are clearly adding another choice to the printer buying decision. In fact, according to Steve Josselyn, senior consultant at IDC, the sophistication of these machines has been the catalyst for DP/MIS departments to create printer purchasing policies.

"Some of the issues are changing, and companies are looking to establish policies for centralized vs. decentralized printing," Josselyn explains. "Before, there were not enough products to choose from, and decentralized groups which wanted high-quality printing didn't have many options. Products are coming out now which are changing that."

The products cover a range of technologies such as ink-jet, electrophotographic laser, ion deposition, LEDs, liquid crystal shutters, magnetography and thermal transfer. Though all have virtues, laser printers have clearly captured the early lead in the nonimpact race.

"Lasers are hot," DEC's Bernard says. "Our customers are asking for them."

The high end

It may seem that the excitement surrounding laser printing began just yesterday, but the technology is an old and established one in the data center. IBM introduced its 3800 high-speed laser printer in the early 1970s, and Xerox followed quickly with its 9700 laser printer.

Capable of speeds in excess of 200 page/min and all-points addressable graphics, these behemoths revolutionized the high end of DP printing for very specialized markets. Banks, insurance companies, large retail outlets and other institutions with massive

forms and billing needs turned to the high-speed laser printers and were willing to pay \$300,000 and more for each machine.

According to Pesko, most Fortune 1,000 companies already have one of these machines in place, and when volume grows, they simply buy another. They often turn out between 1.3 million and two million prints per month. "You need someone

full time just pushing paper through them," he says.

Although these machines pumped out paper, they had little flexibility and showed little promise for moving out of the centralized environments. They did, however, give DP managers a taste of what lasers could do.

"Lasers have a strong position in the centralized environment," Pesko says. "They See **PRINT UPDATE/12**

NONIMPACT PRINTER OPERATING ENVIRONMENT CHARACTERISTICS

Operating Environment	Printing Speed (Page/Min)	Typical One-Year Print Range	Typical Volume (Page/Year)
Centralized	30+	\$300,000+	1,000,000+
Satellite	35 to 60	\$40,000 to \$100,000	20,000 to 100,000
Office Cluster	10 to 35	\$12,000 to \$35,000	5,000 to 20,000
Workstation	Less than 10	\$2,500 to \$10,000	500 to 3,000

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Update

PRINT from UPDATE/11

are well over the pioneer stage, and their reliability is known. The interest started at the top and is moving down."

These high-end machines have not truly driven the nonimpact printer market, however. Though IBM and Xerox have enhanced their products over the years, the technology has remained of

the plain vanilla variety, and the prices have not come down.

The Xerox 9700 actually has more flexibility than the IBM 3800 because it allows dual-sided, cut-sheet printing, but many industry analysts believe that the high-end market is saturated.

"I don't think that IBM and Xerox between them have sold more than 3,500 units in all this time," de-

clares Datek's Dower.

"That's because [the units] cost \$300,000 and were being sold into very specialized environments. Once IBM and Xerox sold to all those people, there wasn't much of a market left to sell. By and large, at that end, there has been no change."

Josselyn tends to agree. Users in large sites, he notes,

are facing the same issues as they did over the last five to 10 years. The 9700 has added more functions and more clarity, but its cut-sheet paper, while an advantage in some environments, has caused problems for others.

"Users have complained that handling and distributing that paper is more difficult than fanfold [paper]," he explains. "They need some kind of binding mechanism."

Xerox's Kiel nonetheless denies that the market has been saturated and points out that shipments for the 9700 have increased over the IBM 3800 because of its ability to do cut-sheet and duplex printing.

"It's an interesting phenomenon," he says. "I would have thought that by 1982, that market would be saturated. But we are finding that the technology is so well accepted that, as people are starting to replace their older printers, they are going straight to nonimpact tech-

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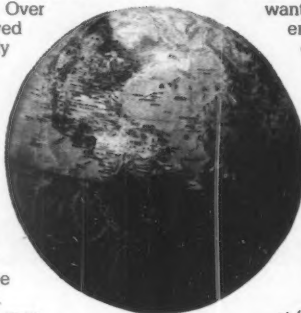
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nologies. Our activities for the 9700 have not slowed down at all."

Pesko adds that he expects IBM to unveil a cut-sheet option for the 3800 sometime this year.

While growth in printed page volume in the data center is expected to be relatively low (perhaps 5% to 10% annually), a trend toward nonimpact technologies in that environment is anticipated.

Consultants agree that ultra-high-speed workhorses like the 3800 and 9700 will continue to reign as the machines of choice. The real dogfight will commence between lower speed laser printers — such as Xerox's 8700 and IBM's 6670 — and the entrenched line printers.

The middle ground

As the market moves down into remote printing departments, distributed DP sites and office clusters, the confusion factor for printer purchases increases. It is in this battleground that DP managers face the hardest choices between impact and nonimpact machines.

A reported 55 vendors now offer nonimpact page printers, and 85% of those products were introduced in the past two years. As vendors such as IBM, Xerox, HP, QMS, Inc. and Southern Systems, Inc. unveil more products, the DP manager is inundated with, and must make sense of, a number of technologies and machines.

This segment of the market is particularly confusing because there is so much price/performance overlap.

See **PRINT UPDATE/13**

Update

PRINT from UPDATE/12

According to Pesko Associates, printers in this environment operate at speeds between 35 and 80 page/min and currently cost between \$40,000 and \$100,000. But above the desktop level, there is a large number of machines in the 12 page/min to 24 page/min range being installed.

According to Dataquest's Steiner, "The trend we are seeing is that old line printers are still doing their jobs, but the DP managers are getting more involved with non-impact printers and have installed one or two. Not the 9700 or 3800 type, but the 12 [page/min] to 20 [page/min] class is being installed in the data center, and people are learning how to use them to serve the client base. They are learning how to put out, not tons of greenbar [paper], but product with graphics."

While IBM's 6670, introduced in 1979, and the yet-to-be-shipped 3820 take on the Xerox 8700, 5700, 2700 and new 3700 and HP's 2680, the entire lot must struggle against the matrix line and band printers for acceptance. And trying to find a share of the crowded market are alternative technologies such as ink-jet printing, thermal transfer and ion deposition. It will not be easy.

"It is very hard for a new technology to establish itself in the market," Dower says, "particularly when there are enormously strong technologies against which it competes. And nonimpact page printers really require a whole new set of application software and application understanding, which didn't exist in the past."

Clearly, the uncovering of new applications that impact printing cannot handle will drive the nonimpact printer market. Corporations are beginning to consider the benefits of bringing into the data center more of the corporate publishing requirements now that they have affordable, flexible machines. The external printing bills for newsletters, forms and reports have traditionally been astronomical. High-speed page printers, which are underused in their new settings, are being put to use for in-house publishing.

"The growth of the electronic printing and publishing segment [of the market] will require a significant market development effort," states a report on nonimpact printing from Pesko Associates. "Electronic printing systems will begin to replace existing printing and duplicating equipment for both in-house and commercial printing. These new systems will offer substantial labor sav-

ings by displacing many manual steps in the traditional prepress, press and postpress areas. Consequently, electronic printing systems will represent a revolutionary change in the entire way in which printed matter is produced."

The low end

As laser technology has made its way to the desktop, it has gained more attention

than ever. Drops in speed and price and improvements in electrophotographic techniques have suddenly spawned a new and exciting market.

The Japanese have dominated the middle and low ends of the laser marketplace because of their advanced photocopying technology, upon which laser printing is based, and automated manufacturing capa-

bilities. Steiner of Dataquest suggests that a multicolor laser printer will emerge from Japan within the year.

Consultants point out that if a laser printer is not entirely made by a Japanese vendor, its engine almost certainly is.

Not surprisingly, therefore, it was Canon U.S.A., Inc.'s LBP-CX personal non-

impact page printer that turned the industry on its ear when it was introduced in late 1983. Though Canon did not begin to ship its own printers until earlier this year, it sold the product through OEM agreements. The machine cost less than \$10,000, a figure seemingly unattainable heretofore. Canon broke new ground in price/performance for laser

See **PRINT UPDATE/14**



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Update

Advanced components drive printer mart

By Maureen R. McManus
Special to CW

The term "page printer" has been confined to monolithic page printing systems such as the Xerox Corp. 9700 or the IBM 3800. These \$325,000-plus monsters printed a page at the blink of an eye and chewed up over one million pages per month operating on the "click, click, click" method. Every time it clicked the image, the end user paid. The footprint was the size of a truck, and

McManus is the manager of the printer market program for International Data Corp. in Framingham, Mass.

undoubtedly the driver was a DP operator. Unquestionably, the technology was laser.

A great deal has changed, giving users a multitude of hard-copy options to fit their specific needs. Much in the same way that their host systems preceded them, page printers began their descent toward distributed printing with the advent of machines like the Xerox 2700, a 12 page/min laser printer costing approximately \$20,000. Hewlett-Packard Co.'s Laserjet practically leaped into the laps of the end user in 1984 as the foremost vendor in a line of Canon U.S.A., Inc. LBP-CX OEMs. Price tags on this new generation of lasers run as low as 1% of their forefather's cost, and vendors such as

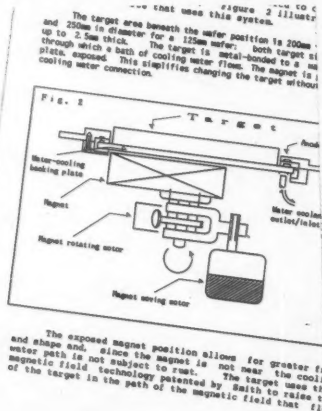


See MCMANUS UPDATE/23 McManus

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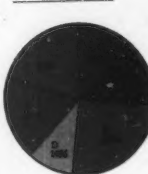
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Revenue (by district)



Revenue (USD)



PRINT from UPDATE/13

printers and began to drive the low-end market it had spawned.

Canon also decided to sell its 8 page/min print engines to U.S. vendors who wanted into the market but did not have the time or money to invest in internal development.

Canon engines already can be found in products from nearly 20 U.S. vendors, including Apple Computer, Inc., HP and QMS. It was HP's Laserjet, introduced in 1984 for \$3,500, that proved that the technology really could be had for less than \$20,000.

The desktop laser printer is unquestionably a product to be reckoned with. Its ability to print text and graphics on the same page, quiet operation and multifont printing on a single page are all attributes.

"They appeal to the artist within us," HP's Ulfers adds.

New forms of laser technology are also appearing as companies jockey for position and advantage. Liquid crystal shutters and LEDs are being used as alternative ways to send the light source to the paper.

The desktop laser printer is not a panacea, however, and it has a long way to go before it can compete with the serial dot matrix machines. The Canon LBP-CX engine, for example, has a duty cycle of only 3,000 page/mo, which is considered extremely low by impact machine makers. There is also a need for new software to drive all the LBP-CX's capabilities. In addition, laser printers tend to be less reliable than impact printers.

Although \$3,995 is a remarkable price for a laser printer, it is still high for the low end. Xerox's Kiel predicts that the price will drop to the \$1,500 to \$2,000 range by 1987, but the low-end laser printer will need acceptance as a shared peripheral to get into corporate America.

Apple has taken the desktop laser printer to another plateau. Its Laserwriter, introduced earlier this year as part of the Macintosh Office system, is also based on the Canon engine but goes a few steps beyond the Laserjet. At \$6,995, it is significantly more expensive than the Laserjet, but it offers multiple professional typefaces; full-page, high-resolution graphics; and new ways to lay out text and graphics on a page using Postscript, a programming language for page description.

See PRINT UPDATE/16

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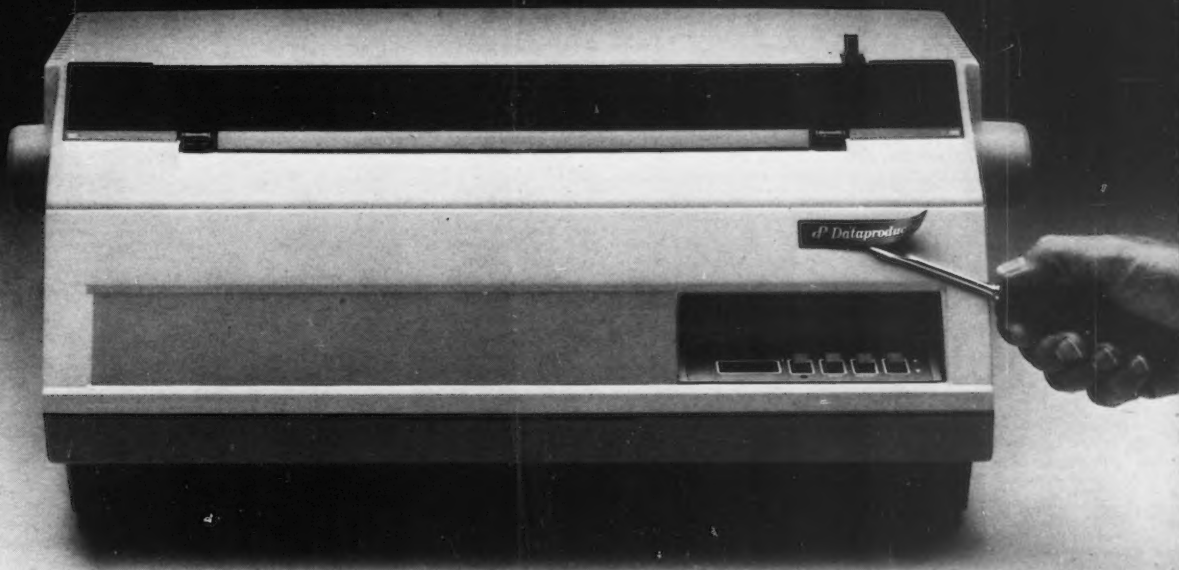
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Update

PRINT from UPDATE/14

The Laserwriter also incorporates a Motorola, Inc. 68000 microprocessor, as does Apple's Macintosh, and, in fact, features nearly three times the random-access memory of a 512K Macintosh and 20 times the memory of the HP Laserjet.

According to Apple's Bruce Blumberg, product manager for Laserwriter, the product is attempting to change the standard for internal communications. In particular, it is attempting to address the question of where in-house publishing fits in the corporate organization. To date, the data center has shied away from in-house publishing, but increasingly, the margins between the two are blurring, Blumberg points out.

"We're providing the tools to allow people to do in-house publishing significantly cheaper, with a faster turnaround and better results," Blumberg says. "That's the kind of thing DP people are going to be increasingly involved with."

Steiner agrees and says he expects that Laserwriter-type technology will move up to the high end to allow DP shops to handle large in-house publishing requests. "There will be a lot of demand for publishing," he says. "As people get more and more into doing spreadsheets and graph-



ics, they can pull out four or five pie charts and assimilate information more rapidly. If they can have that, why can't the president or vice-president have the same thing? It's not realistic to expect them to look through a stack of greenbar anymore."

The Laserwriter has been extremely well received by consultants, but it too has drawbacks. Al-

though it works well in its native Macintosh environment, it loses much of its capability with other systems, such as IBM's. Apple has turned to third-party software developers to try to solve that problem, and such companies as Microsoft Corp. and Studio Software have already developed driver programs to tie Laserwriter to the IBM Personal Computer.

In terms of in-house publishing capabilities, the Laserwriter is currently alone in the field. "Before this, you needed a \$50,000 [Interleaf, Inc.] machine to do this kind of work," says McManus of IDC. "This is really a breakthrough product."

Xerox and DEC both introduced their answers to Apple's printer. DEC's LNO3 laser printer uses a Ricoh Electronics engine and retails for \$4,195. DEC's Bernard says that it is a more general-purpose machine than the Laserwriter.

As more companies plunge into the still-cold waters of low-end non-impact printers, the outlook is optimistic but cautious. Says the report from IDC, "Lasers are expected to do well, with 1984 shipments of about 16,000 [increasing] to nearly 200,000 for 1989. Overall though, they are expected not so much to totally supplant other types of printers as to augment a business' varying personal computer printing needs."

Ink-jet technology

The nonimpact technology that is most likely to encroach upon laser territory is ink-jet printing. Ink-jet printers have been on the market for several years, but they have yet to show a commanding presence. Ink-jet technology, however, continues

See PRINT UPDATE/18

PRINTER SUMMARY

Impact

Technology	Type	Speed	Print Quality	Character Sets and Resolution	Advantages	Limitations	Price Range
Delaywheel	Serial	12 to 90 char./sec.	Excellent letter quality; sharp edges, no scallops	96 to 200 char./wheel; overstrike increases number of characters; graphics resolution to 120 by 96 dot/in.	Interchangeable fonts, low cost, good reliability	Slower speed than impact serial matrix	\$500 to \$8,000
Serial Impact Matrix	Serial	30 to 600 char./sec.	Draft to near-letter quality; 200 char./sec. draft, individual dots; 110 char./sec., scallops; 35 char./sec., near-letter quality, low uniformity and rough edges	Graphics resolution to 240 by 240 dot/in.	One printer for multifunctions; print quality changes with speed; color graphics possible; good reliability	Low resolution with sparse dot matrix	\$250 to \$6,400
Line Impact Matrix	Line	80 to 900 line/min.	Draft to near-letter quality; at 80 line/min., near-letter quality, low uniformity and rough edges	Graphics resolution 50 by 50 dot/in. to 160 by 168 dot/in.	One printer for multifunctions; print quality changes with speed; color graphics possible; good reliability	Low resolution with sparse dot matrix	\$3,500 to \$17,000
Drum	Line	300 to 2,000 line/min.	Utility to correspondence to optical character recognition (OCR)-readable	Fixed character set to 96; graphics only by printing characters	Heavy-duty printing with low maintenance; very good reliability; some print MICR* checks	No interchangeable character sets	\$10,000 to \$50,000
Chain or Train	Line	600 to 2,000 line/min.	Utility to correspondence to OCR-readable	Interchangeable fonts to 128 char./set; graphics only by printing characters	Interchangeable fonts; long life; good reliability	Chain or train track wear; more expensive and slower than band technology	\$12,000 to \$80,000
Band or Belt	Line	200 to 3,600 line/min.	Utility to correspondence to OCR-readable	Interchangeable fonts to 128 char./sec.; graphics only by printing characters	Interchangeable fonts; capable of heavy-duty printing; very good reliability	Entire band needs replacement if one character wears	\$4,000 to \$109,000

Nonimpact

Direct Thermal	Serial and Line	15 to 300 char./sec., 200 to 450 line/min.	Draft to near-letter quality	Resolution 64 by 64 dot/in. to 90 by 90 dot/in.	Low cost; low noise	Requires special thermal paper; heads have limited life	\$175 to \$1,900
Thermal Transfer	Serial and Line	11 to 300 char./sec., 66 to 660 line/min.	Draft to near-letter quality	Resolution 70 by 70 dot/in. to 240 by 360 dot/in.	Uses plain paper; color graphics possible	Ribbon cost is fairly expensive, up to 30 cents/sheet	\$199 to \$2,000, serial; \$2,500 to \$12,000, line
Electro-erosion	Serial and Line	160 to 2,200 char./sec., 90 to 200 line/min.	Draft to utility — serial; photomaster book quality — line	Resolution: to 160 by 160 dot/in. — serial, 600 by 600 dot/in. — line	Fast and quiet — serial; high print quality for photomasters — line	Paper appearance is metallic and can wrinkle — serial; metallic appearance no problem for photomaster	\$495 to \$2,000, serial; \$21,000, line
Ink-jet	Serial and Line	20 to 270 char./sec., 300 line/min.	Draft to almost letter quality	Resolution 80 by 90 dot/in. to 300 by 300 dot/in. to 224 by 480 dot/in.	Quiet; color graphics possible; relatively low supplies cost	Optimum printing on some with special papers; reliability on some not too good due to nozzle clogging	\$495 to \$22,000
Electrostatic	Line and Page	300 to 11,000 line/min.	Correspondence to near-letter quality	Resolution 100 by 100 dot/in. to 400 by 400 dot/in.	High speed for printer application; low speed for plotting to 72 in. wide; color available	Requires special dielectric paper and liquid toner	\$5,000 to \$165,000
Magneto-graphic	Page	10 page/min. to 50 to 90 page/min.	Near-letter quality	Resolution 240 by 240 dot/in.	Quiet; high speed; good reliability for nonimpact page printers	Lower resolution than electro-photographic	\$2,600 to \$25,000
Ion Deposition	Page	60 to 120 page/min.	Near-letter quality; uses pressure fusing, hence, a somewhat shiny appearance	Resolution 240 by 240 dot/in.	Quiet; high speed; better reliability than electrophotographic; can print MICR* for checks	Lower resolution than electrophotographic	\$60,000 to \$80,000
Electro-photographic	Page	8 to 214 page/min.	Almost letter quality	Resolution 180 by 144 dot/in. to 400 by 400 dot/in.	Ranges from quiet, low speed and inexpensive to very high speed, high volume and expensive but competitive cost per copy	Reliability lower than maintenance requirements and higher than some impact printers	\$3,500 low-end to \$400,000 high-end

* Magnetic ink character recognition

Source: Dataproducts Corp.

Update

A guide to cost-justifying smart nonimpact printers

By Charles A. Pesko
Special to CW

With a growing market creating more demand for intelligent copier/printers, potential end users need specific, accurate and timely product information. Along with speed, print quality, reliability and flexibility, cost of ownership is an important criterion by which to compare intelligent copier/printers to each other and to traditional impact printers.

An intelligent copier/printer is a nonimpact output device that accepts electronic input and produces hard-copy output of at least correspondence-level print quality. Examples of intelligent copiers/printers are the IBM 3800, Xerox Corp. 9700, Hewlett-Packard Co. Laserjet and Apple Computer, Inc. Laserwriter.

One feature that distinguishes the intelligent copier/printer from other printing systems is its internal capacity to create, format and manipulate many type styles and sizes within a document or within a page.

In some cases, intelligent copier/printers can merge text with graphics and images of great complexity. This process is under the direction of sophisticated, programmable controllers that can create electronic documents efficiently and economically.

There now exist many intelligent copier/printer products using several technologies. Each product offers its own set of features, format flexibility, host interfaces, print quality and speed. However, to make informed decisions, end users also require cost-of-ownership data based on an objective comparison.

As part of the Intelligent Copier/Printer Market Requirements Service, C. A. Pesko Associates, Inc. has developed a cost-of-ownership computer model. By keeping major cost elements and assumptions consistent, useful comparisons can be made. The DP manager considering the acquisition of intelligent copier/printers for installation may use such a comparison in an in-house, cost-justification exercise. A cost-of-ownership calculation form is included below for use with these formulas.

There are four key elements and three minor elements in calculating cost of ownership. The major elements include the acquisition cost of the system, service/maintenance costs, usage charges and consumables.

The minor elements are floor space, electrical power and labor. Because of the extreme variability of the minor elements, we have excluded them from the model. However, the potential intelligent copier/printer end user would do well to consider these elements within the context of his company.

Configurations. Although each intelligent copier/printer has its unique constellation of feature/benefits, systems in our model are priced with configurations as nearly consistent as possible, as

the following examples show:

■ **Interfaces.** Interfaces are always included. Some systems offer no choice of interface. For those offering choices, be sure to price the interface compatible with your computers.

■ **Paper trays.** Where the option is available on sheet-fed systems, use two trays or more in the pricing.

■ **Fonts.** Fonts may be limited to those included in the basic package. If fonts are not included, add in the price for the minimum number of fonts required.

Amortization. Rental and lease rates vary considerably between vendors and third-party lease companies. When we consider nonpurchased equipment, we use two-year lease rates from the equipment vendor. The comparison of purchased equipment is made at quantity one end-user list price, amortized over 60 months. We disregard the cost of money on purchased equipment. However, we recommend that you consider it in your evaluations as it will, in many cases, diminish the cost advantage of purchased equipment.

Supplies

Supplies prices are taken from the equipment vendors' catalogues. For quantity discount purposes, prices are taken generally at the one-month usage level or at the first price break, whichever quantity is higher. In the centralized environment, volumes are usually high enough to qualify for the greatest discounts.

Production yield of a supply item can vary significantly between end users, and some supply vendors are more sanguine than others in quoting yields. Therefore, this analysis uses the production yield figures quoted by the equipment vendors.

Paper. Paper, like other consumables, varies in price according to volume. In the centralized environment, with more than one million prints per month as an average volume, we use the lowest average paper price as follows:

■ **Cut sheet.** Cut sheet measuring 8½- by 11-in. at \$.00425 per sheet.

■ **Continuous form.** Continuous form measuring 8½- by 12-in. at \$.00525 per sheet.

Average monthly print volume (AMPV). The cost of ownership of each system is examined at four evenly distributed AMPVs within the general volume limits of the centralized environment. In most companies, print volumes grow over time. Examine the results of increased volume on your cost per print.

Print speed. Vendors' published print speeds are used throughout the model. The average page may be assumed to be 40 lines of 60 characters each, for the purpose of converting lines per

COST-OF-OWNERSHIP CALCULATION FORM

Average Monthly Print Volume (AMPV)
To be produced on IC/P*
(Total number of 8½- by 11-in. impressions) _____ (1)

Average Paper Cost per Month
(line 1 ÷ 1000) _____ (2)

Your best paper cost per 100 _____ (3)

Average paper cost (line 2 x line 3) _____ (4)

Production Schedule
Number of shifts worked/mo. _____ (5)
Number of hours/shift _____ (6)
(line 5 x line 6)
Total min./mo. (line 5 x line 7) _____ (8)

Analysis Period
Number of years _____ x 12 _____ (9)

Number of IC/P Units Needed _____ (10)

Vendor's recommended AMPV _____ (11)

(Analysis of the maintenance contract and use charges will determine whether this number should be rounded up or down.)

Equipment Cost
Make and Model _____
Basic unit price _____ \$ _____ (12)
Interface, if extra _____ \$ _____ (13)
Fonts each, if extra _____ \$ _____ (14)
Number required _____ (15)
Total for font _____ \$ _____ (16)
(line 14 x line 15)
Software, if extra _____ \$ _____ (17)
Other options _____ \$ _____ (18)
_____ \$ _____ (19)
_____ \$ _____ (20)
_____ \$ _____ (21)

Monthly Maintenance and Service Costs
Contract Plan _____
Days covered _____ through _____
Hours covered _____ to _____
Guaranteed arrival within _____ hours
Contract cost/mo. _____ \$ _____ (24)
(Note: Be sure to include charges for optional equipment.)
Additional coverage, if required and available
Days covered _____ through _____
Hours covered _____ to _____
Add-on cost/mo. _____ \$ _____ (25)
Total Maintenance and Service Cost
(line 11 x [line 24 + line 25]) _____ \$ _____ (26)

Use Charges (if any)
Number of prints/mo., if any, included under maintenance contract or flat charge per print _____ \$ _____ (27)
_____ \$ _____ (28)

Use Charge Structure

Based on AMPV (line 1) and use charge structure, calculate your average monthly use charge total. Do not forget to correct the print volumes per unit by (line 11). _____ \$ _____ (29)

Supplies Cost

Supply Item	Unit Packaging	Yield: Prints per Package	AMPV (line 1)	Packages per Month (line 1 ÷ line 2)	Best Price per Package at Monthly Quantity	Supply Cost per Month (line 4 x V)
Toner						
Ink						
Developer						
Fuser						
Drum						
Filter						
Total Supplies Cost (sum of column VI)						\$ _____ (30)

Cost of Ownership by Cost Component

Equipment (line 21 + line 1)	\$ _____ (31)
Maintenance (line 24 + line 1)	\$ _____ (32)
Use Charges (line 27 + line 1)	\$ _____ (33)
Paper Cost (line 4 + line 1)	\$ _____ (34)
Supplies Cost (line 28 + line 1)	\$ _____ (35)
Total Cost per Print (sum of lines 29 through 33)	\$ _____

* Intelligent copier/printer

Source: C. A. Pesko Associates, Inc.



Pesko

Pesko is president of C. A. Pesko Associates, Inc., a Marshfield, Mass., consulting firm specializing in the intelligent copier/printer field.

minute to pages per minute. In instances where equipment uses continuous-form paper and print speed was quoted in inches or feet per second, the model assumes the use of 8½- by 12-in. form, running on the 8½-in. axis.

Shift and duty cycles. For the centralized environment, printers are assumed to be available three shifts per day, 25 days per month. These figures were obtained through end-user research.

Based on quoted print speed and the total shift time described above, duty cycles were calculated for each AMPV. As a rule, intelligent copier/printer manufacturers recommend AMPVs work out to low-duty cycles for workstation systems and higher duty cycles in the high-end environments. The duty cycle can be calculated by taking

See COST UPDATE/19

Update

IBM marshaling resources for printer mart offensive

By Glenn Rifkin
Update Editor

"IBM is getting very serious about hard copy," states Maureen McManus, manager of the printer market program for Framingham, Mass.-based International Data Corp. Indeed, IBM is no stranger to the printer business. Big Blue's band printers have been staples in DP centers for years, and its ultra-high-speed 3800 laser printer ushered that technology into the DP shop.

But now, IBM is gearing up to enter virtually every area of printer technology — from the high end to the low end, from impact to nonimpact — and that will undoubtedly spell trouble for many in the printer business.

Those with perhaps the most to fear are the Japanese printer makers in the low end of the impact and nonimpact marketplace. IBM has fully automated two of its manufacturing plants, in Charlotte, N.C., and Lexington, Ky., and is ready to turn out commodity products similar to what vendors like C. Itoh Electronics, Inc., Epson America, Inc. and Okidata Corp. have done so successfully for the past five years.

"IBM is going after the Japanese with a vengeance," says Charles Pesko, president of C. A. Pesko Associates, Inc. "And if anyone can compete with the Japanese, it's IBM."



Perez

It is at this low end, the personal computer printer market, that IBM will have the most impact. After being an OEM for Epson printers for several years, IBM decided it would be more profitable to go into the market alone. "IBM views the personal computer-related printer business as one of opportunity," says Dan Perez, manager of peripherals marketing in IBM's National Distribution Division. "The fact that in the last six or eight months we have announced four printers, at least three of which are totally developed and manufactured by IBM, is a visual expression of our commitment."

In May, IBM introduced its \$549 Proprinter, a serial dot matrix unit that operates at three speeds and can be used for single-sheet or continuous-feed paper, multipart forms or envelopes. The Proprinter was designed and is manufactured at IBM's Charlotte facility. The company also introduced the \$745 Color Jetprinter, a buyout from Canon U.S.A., Inc. that uses four ink-jet nozzles to create seven colors for charts, graphs, spreadsheets or high-quality text. At the low end, IBM also offers its compact printer for \$250; the \$1,395 Quietwriter, which uses thermal transfer technology; the \$1,795 Wheelwriter, a fully formed daisy-wheel printer with an integrated sheet feeder device; and a

extremely inexpensive. Okidata, for example, offers its Okimate 20 for less than \$300. Unfortunately for thermal transfer technology, it generally requires the use of special thermal paper or, in some cases, a special thermal ribbon. That may be its biggest drawback. "One thing history has shown in the market is that users will do anything to avoid using special paper or supplies," Dower says. "They want to get paper out of the drawer and use it."

IBM, with its recently introduced Quietwriter (\$1,395), may have partially solved that problem. The Quietwriter, which is targeted at the higher speed and higher cost daisy-wheel impact printer market, uses a thermal-resistive ribbon but can effectively print on any paper surface. Unfortunately, Steiner says, IBM is still getting the bugs out of the ribbon, and supplies of Quietwriter have been limited. Because of its relatively low cost and ability to handle color, thermal transfer continues to gather interest. Dataquest predicts that several vendors will soon introduce high-quality thermal transfer units to compete with IBM's Quietwriter. "The Quietwriter is a key product for that technology because it's from IBM and also because

\$1,995 color graphics printer, an impact printer that also originates from outside the company.

According to Pesko, IBM will add to its strength with a tabletop laser printer in the near future. That product, when it appears, is expected by some in the industry to do for desktop laser printers what the IBM Personal Computer did for personal computers.

As IBM gears up for the low end of the market, consultants expect a bloodbath for many of the smaller printer vendors who will simply not be able to keep up with the volume pricing of which IBM will be capable.

"A lot of companies will fall by the wayside because of IBM," McManus says. "Price erosion is just beginning."

Price/performance driving the market

Perez points out that he expects price/performance levels to drive the market. "Implicit in price/performance is reliability," he states.

"People want machines that stand up over a long period of time and require minimal repair. . . the printer is really nothing more than the output extension of a computer and what you don't want is to be impacted on the computer end because of the output device."

IBM also has a strong interest in middle and high ends of the printer business. According to Jack Smulovitz, IBM's impact printer products development planning manager, the company has migrated all of its impact machines into band technology.

Having recently introduced its 4245 band printers (CW, May 13), with Models 12 and 20

See IBM UPDATE/22

PRINT from UPDATE/16

to draw praise.

"Lasers will get a considerable amount of pressure and competition from ink jet as ink jet finally gets the bugs out of it," says Steiner of Dataquest. "It will offer color more easily and cheaply than laser [does]."

"It's a fabulous technology," Dower adds. "But I'm not convinced it is going to sweep the country by storm."

Although it has a high-level print quality and can run at fast speeds, ink-jet printing has had minimal market penetration to date. There is still a question about its sensitivity to the media on which it prints — on rag or ground-wood-type paper, the ink tends to spread a bit before it dries — and reliability continues to be an issue.

Nonetheless, ink-jet printing has mustered enough support from major vendors such as IBM, HP, Epson and Diablo Systems, Inc. that it cannot be ignored. The technology got a big boost in 1984 when HP introduced its Thinkjet printer, which was priced so low (\$495) and had such good print quality that the industry sat up and took notice. IBM put its stamp of approval on the market this year with its \$745 Color Jetprinter, which it purchased from Canon.

HP's Ulfers points out that his company has made a strong commitment to ink-jet technologies, even more than it has to laser technology.

Although ink-jet printing has been tried at every end of the market, its strength appears to be at the low end. Diconix, Inc., an Eastman Kodak Co. subsidiary, is marketing a 20 page/min machine called the Office Ink Jet, and Dataproducts just announced a joint development agreement with Exxon Enterprises Printing Systems to produce a business computer printer using ink-jet technology. But it is unlikely that the data center market will face a rash of ink-jet products.

"Ink jet could become a major player," Dower says, "but the jury is still out."

Thermal transfer

This technology has gained significant attention at the low end of the market because it is

extremely inexpensive. Okidata, for example, offers its Okimate 20 for less than \$300.

Unfortunately for thermal transfer technology, it generally requires the use of special thermal paper or, in some cases, a special thermal ribbon. That may be its biggest drawback. "One thing history has shown in the market is that users will do anything to avoid using special paper or supplies," Dower says. "They want to get paper out of the drawer and use it."

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Because of its relatively low cost and ability to handle color, thermal transfer continues to gather interest. Dataquest predicts that several vendors will soon introduce high-quality thermal transfer units to compete with IBM's Quietwriter.

"The Quietwriter is a key product for that technology because it's from IBM and also because

it can print on rougher surface paper," Steiner says. "You'll see more and more thermal transfer products like that in late '85 or early '86."

Ion deposition

Ion deposition — another "new" technology that is actually 10 years old — has recently begun to win a small band of converts. Ion printing is a relatively simple procedure that uses an ion projection cartridge that produces an electrostatic image directly on a dielectric drum by projecting an array of charged particles. Characters are formed when the particles are projected in a dot matrix pattern to the rotating drum's surface.

Unlike lasers, there is no rotating mirror to direct the laser beam, and less heat is generated. There is also no toner recovery system (ion printing has a reported 99.7% toner transfer), and the drum is hard and durable (see chart Update/23).

With fewer moving parts and no need for a specialized environment, ion deposition printers have several advantages over lasers. Delphax Systems, Inc. of Westwood, Mass., which holds all proprietary rights to the technology, is trying to cash in on these advantages.

Delphax is an outgrowth of Dennison Manufacturing Co. of Framingham, Mass., and Canada Development Corp. and was set up to market ion printers and sell ion printer engines to OEMs. Several firms have bought into the technology, including Xerox, which recently purchased Canada Development's share of Delphax and plans to introduce an ion deposition printer in August.

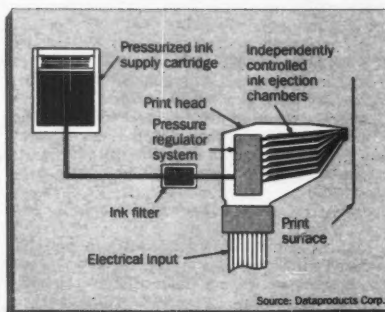
Ion deposition currently targets the data center. Delphax markets its S6000 printer, a 60 page/min machine, to centralized environments and is ready to announce a 90 page/min version soon. Southern Systems sells the Mercurion 1, which uses the Delphax engine, to data centers.

"The response has been excellent," says Don Dooley, national sales manager for Southern Systems. "We've shipped 300 machines in two years, and we have the largest base of ion deposition machines out there."

Ion deposition printers — although incapable of duplex printing — are reportedly more

See PRINT UPDATE/19

INK-JET PRINTER



Source: Dataproducts Corp.

Update

PRINT from UPDATE/18

reliable than laser printers because they have fewer parts and procedures and cost less. The Delphax \$6000 costs \$60,000 to \$80,000.

"[Ion deposition is] a potential player," Pesko says. "It can cover a broad range of applications in the centralized environment."

For Delphax, Xerox's interest has been a boon.

"Having Xerox as an investor certainly legitimizes the product," says Mark Casey, a product specialist at Delphax. "People realize that it's not some perpetual motion machine we cooked up in the garage."

Magnetographics

Magnetography uses magnets instead of lasers to create the image. These printers use a thin-film magnetic recording head to generate dot images on a magnetically coated drum. The head uses specially designed elements that let the printer place dots close together without magnetic interference.

As the drum rotates, it contacts dry monocomponent toner that adheres to the magnetic images. These images transfer to plain paper, and the printer heat fuses them to ensure that characters are sharp and distinct.

Consultants consider this technology, along with ion deposition, the most promising of the new printing techniques. Magnetographic printers have an advantage over other nonimpact machines in that they can store their own images and duplicate at faster speeds.

The market has been slow to accept this technology. Only Ferix Corp. in Sunnyvale, Calif., and Cynthia Peripherals, Inc., the U.S. subsidiary of Compagnie de Bull in France, sell magnetographic printers. Their products, like those of Delphax, are aimed at the high-speed market. Ferix, however, has encountered difficulties and recently laid off half its work force.

"They are at a stage a lot of start-ups get to. They are two steps from what might be success, but it gets very expensive," Steiner says.

The buying decision

Deciding what printer to buy used to be relatively simple for the DP manager. The technologies were few and clearly differentiated. Price/performance determined the selection, and like all peripherals purchases, the decisions were never considered high priority or critical.

Today, the buying decision is considerably tougher, and the lines between technologies have blurred. The questions that a buyer must

See **PRINT** UPDATE/23

COST from UPDATE/17

the recommended print volume and dividing it by the total number of prints produced theoretically if the machine ran constantly. The highest duty cycles are in the centralized environment and average about 35%. A few vendors go as high as 45%. Higher duty cycles are a feature of impact printers.

Multiple units. The end user's decision on how many units of a printer are needed is based on volume requirements, acceptable downtime and cost of ownership. In many cases, these price structures offer the intelligent copier/printer user a strong financial incentive to add units rather than to exceed a given AMPV.

Service/maintenance contracts and usage charges. The cost of the individual service contract on each specific system is included in the model. It is recognized, however, that many large end users have blanket contracts, with full-time, on-site personnel servicing a variety of equipment.

The highest level service/maintenance contracts available — guaranteed on-site within four or eight hours — were chosen on the assumption that these systems are used in locations where extended downtime is unacceptable.

Vendors approach usage charges in one of the three following ways:

- Flat rate per "click" regardless of volume.
- Graduated charge, based on volume increments.
- No usage charge.

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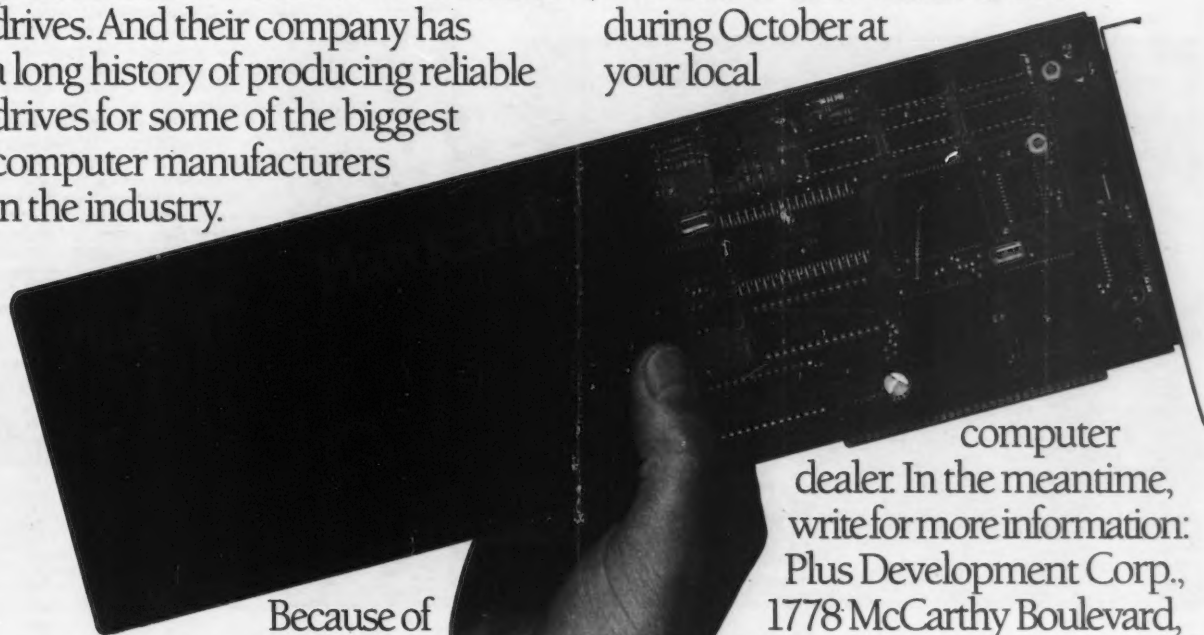
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Hardcard

from Plus

Update

JAPAN from UPDATE/5

the Western markets could be served by the same head design.

Thermal transfer printer development was highly emphasized in Japan because of its potential to provide reliable, quiet, low-cost devices with a choice of color or monochrome printing. The U.S. market did not respond quickly to the thermal printer offerings because of the smooth paper required. IBM, however, responded to the challenge by introducing the Quietwriter printer.

The Quietwriter uses a different approach to thermal transfer printing called thermal resistive ribbon printing, in which the ribbon and not the head heats up. Also differing from the Japanese approach, IBM's

thermal resistive ribbon, rather than the traditional waxed-base ink, transfers thermoplastic to paper.

IBM was able to use the thermal resistive ribbon approach, coupled with a complex head design, to print high-quality text on a wide variety of common office paper types. Japan is responding with several new products. Okidata has been successful in opening the low-cost personal thermal transfer printer market with the Okimate series offering color at a very reasonable price.

The latest Japanese influence on the U.S. printer market has been in the lower speed segments of laser printers. Canon U.S.A., Inc. certainly broke this market wide open with the introduction of the LBP-CX. The popular Laserjet printer from HP is

based on the Canon print engine.

Prior to Japan's entry into the laser printer arena, there were no offerings less than \$19,000. Now the price for 8-page/min laser printers averages approximately \$2,800 for text-based devices. Dataquest expects these prices to drop to approximately \$2,000 by mid- to late 1986.

Most of the Japanese influence on the U.S. printer market has been concentrated on the lower speed, high-sales volume devices. Japan has become a formidable competitor in this market.

Several U.S. vendors have successfully responded to the challenge, but Japanese firms claimed more than 70% of personal computer

printer shipments in 1984. They brought cost-effective printing devices to personal computer and distributed processing users.

At the high end, Japan has had little or no influence on the higher speed electronic printer market in the U.S. To date, these market segments have not offered the opportunity for volume or mass-production cost savings.

The level of support required in these high-speed markets is also a barrier to entry, and Japanese vendors would have to have a much stronger U.S. presence to create a solid image in the market. Overall, however, there is no discounting the immense effect Japan has had on the electronic printer industry in the U.S. and in the world. ■

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IBM from UPDATE/18

capable of speeds of up to 1,200 line/min and 2,000 line/min, respectively, IBM has a fully granular product line to offer.

At the top is the 4248, which operates at 3,600 line/min, and at the lower end, the 3262 and 5262, each with speeds of 660 line/min.

When announcing the 4245, IBM also announced a 25% price reduction on the 4248 and a one-year warranty on both the 4248 and 4245 models.

"That is a key point because we feel it is a statement of leadership and quality from our standpoint," said Smulovitz about the warranty.

In the middle and high-end areas of the nonimpact printer market, IBM continues to successfully sell its 3800 laser printer, a \$315,000 machine with speeds up to 215 page/min, as well as its 6670, which operates in the 35 page/min to 80 page/min spectrum.

The company has announced, but not yet shipped, the \$28,000 3820, a high-speed laser printer operating at 20 page/min.

Big Blue also markets its \$21,000 4250 electroerosion printer for document processing and publishing applications.

For IBM, this blanket coverage of the printer market is aimed at providing application solutions for all its customers. Smulovitz indicated that IBM has no interest in taking sides in the impact vs. nonimpact debate. "The market is application driven," he explained.

"Different technologies address different applications. If you look at the total cost of ownership, nonimpact will have to exceed the price/performance [levels] of the impact printers in order to displace them, and we've just set some very aggressive numbers to shoot at. But there are applications that drive both sides."

Although no one at IBM will get specific, both Smulovitz and Perez acknowledged that IBM is looking into many of the alternative printer technologies. "IBM evaluates any technology that has potential," said Smulovitz.

For the competition, IBM's aggressive stance on printers is essentially no different from its positioning in virtually every other computer-related market. And as the market knows, I-B-M usually spells trouble. ■

Update

MCMANUS from UPDATE/14

Kyocera Corp. offer cabinets smaller than a bread box.

Currently, laser technology dominates page printers, with desktop laser printers representing about 99% of the year-end 1984 U.S. shipments of about 38,000 page printers. But many alternatives — such as ion deposition, magnetographics, liquid crystal shutters, LEDs and CRT printers — are emerging to seek a market share in the next few years. At the heart of these machines, the resident controllers and software are becoming more plentiful and powerful, enabling printers of all technologies to perform advanced functions. Vendors are opting for a modular approach, externally sourcing components if necessary, at least initially, to meet their product's market window.

There are three basic components that make up the majority of page printers: the marking engine, controller and resident software. In the past, the market centered around the print engine. The Japanese dominate the low-end, print-engine market, which has essentially become a commodity.

Today the focus and driving forces behind the exploding page printer marketplace lie in the intelligent controller and the software or page generation languages. The raster image processor (RIP) controller houses the printer's intelligence and storage. This computer within the printer performs all the necessary computing — vector-to-raster conversion — and handles the massive amounts of storage requirements needed in generating graphics.

As evidenced in the QMS, Inc., Imagen Corp. and Apple Computer, Inc. controllers, based on the Motorola, Inc. 68000, these are hardy boards in their own right. These internal controller boards enable the host CPU to save its power and memory so that it does not become a slave to the output device. Controllers encompass a wide range of power and capabilities proportionate to price.

In addition to the printer and system makers involved in controller development, such as Xerox, Apple, HP, Imagen and QMS, there have been a number of independents popping up in the last few years such as EMC Corp., Intracorp., Office Automation Systems, Inc. and Lasergraphics, a vendor that specializes in these rasterizing computers for color printers.

Another highlighted issue in page printers is the emergence of page generation languages. Currently, no real standard has yet been set in this arena, so this will be an interesting part of the

market to watch.

The development and digitizing of the typesetting fonts these languages produce is extremely difficult and only two success stories have been written thus far. A few years ago, several former Xerox employees set off on their own and formed Adobe Systems, Inc. in Palo Alto, Calif. They wanted to pursue a purer vision of an interpretive programming language.

That pursuit has resulted in Adobe's Postscript language, which takes a font solution approach — storing its sets as a formula or outline. In this way, they are not locked into addressing every character or size change on a bit-by-bit level, thus saving time and money. Adobe Postscript is both device and resolution independent. Adobe's market is the same one Xerox has been targeting for its Interpress protocol.

Currently, Apple is the largest Adobe Postscript user. Linotype and QMS have also signed agreements, and other major vendors are reportedly close to reaching accords as well.

The Xerox Interpress Printing Architecture, introduced in April 1984, incorporates all of the Xerox Network Systems protocols required for printing documents on Xerox printers. The initial layer of these protocols has been publicly available since 1981, and the new Interpress architecture provides a way for different vendors to use common programs to link their products with each other and with a variety of electronic printers. It reportedly allows users to create documents in any layout and combines any number of line graphics, half tones, scanned images and text.

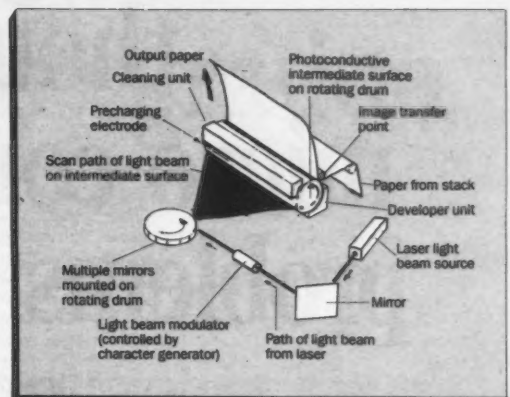
A key element in the Interpress architecture is the Interpress document format language. In the battle between Postscript and Interpress, Xerox has just won a major victory with the announcement of support from 19 companies, including such printer heavyweights as Digital Equipment Corp., Burroughs Corp., Siemens AG, Imagen, Dataproducts Corp. and Interleaf, Inc.

This sophisticated software and components, as stated, are truly the heart of the new wave of nonimpact printers. Depending on the price/per-

formance target market, the wise vendor must carefully match the appropriate pieces at the right time. This requires a lot more understanding, commitment and support in the areas of software, services, distribution, training and marketing of these advanced-function page printers than is required for a volume commercial market of cameras or marking engines. This possibly explains why there has been such a long period of time between the debut of the concept and the shipment of products to the marketplace.

While the Japanese have the technology and marking engines, they do not have, nor do they seem to want, the distribution channels and all the software and support issues that are enveloped with it. Their strength and understanding lie in volume production. They can bring to mar-

LASER PRINTER

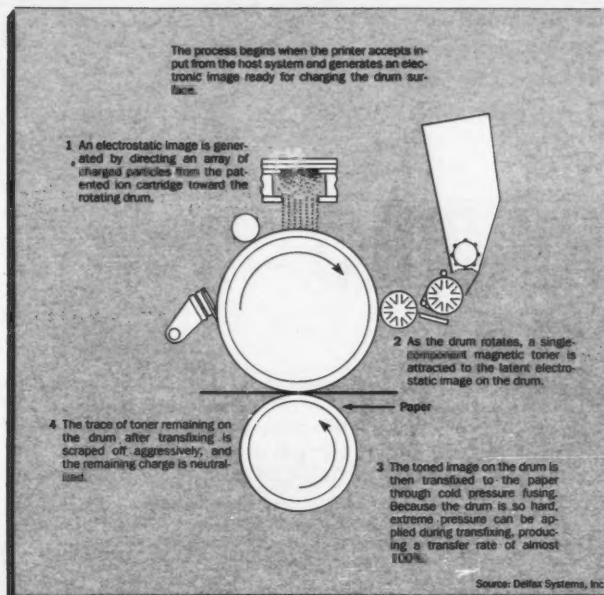


ket a mechanism but not the solution that is needed. Thus the focus on intelligent controllers and page generation languages brings, at least for the time being, the attention and money back to an American market.

It was Apple with its \$6,695 Laserwriter that put all the pieces together with their 68000-based RIP controller and the adoption of Postscript. In a way, the Laserwriter may have already performed its most important market function by promoting user awareness and feeding off the business ego.

Once one end user distributes his presentation, generated on a Laserwriter-like device, to the board of directors, you can bet that is how fellow workers will prepare their reports next month. The Laserwriter is only the first step in a new generation of products that will be faster, more functional and capable of much greater volumes, which enables them to operate as shared resource printers. Nonimpact page printers will change the way business views and accepts its hard-copy output.

ION PRINTING



Source: Deltar Systems, Inc.

PRINT from UPDATE/19

ask have not changed; there are just more of them on the list.

The No. 1 question, consultants and vendors agree, is, "What application do I have to fill?" The application, more than anything else, will dictate where the buyer looks. For the high end, price/performance along with speed continues to be the major concern.

Another question is whether to go with cut-sheet paper or continue with old-style fanfold paper. Currently, graphics and color are still considered luxuries, but according to HP's Ulfers, those features will become mandatory within a couple of years.

In decentralized environments and office settings, print quality, noise, ease of use, reliability and volume are paramount. A major concern for DP managers is putting the right machine in the right location. Overuse or abuse is a serious problem for users who are constantly frustrated by continuous downtime. Although vendors are pressing their sales representatives to point out the correct volumes and uses of their machines, abuse continues and often gives products an undeserved bad name. Temperamental machines, on the other hand, will inevitably begin to gather dust as users shy away.

Although impact printers are expected to remain a viable technology, most industry watchers anticipate that the next generation of computing will turn almost exclusively to the sophisticated, nonimpact offerings. If it comes to pass, it will require a lot of sociological changes, according to Ulfers. Until then, the paper chase will continue.

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IN DEPTH

Three views of voice/data integration

In the new world of voice/data integration, experience is crucial. These three have it. David Rappaport, a partner in Arthur Andersen & Co., is responsible for the firm's telecommunications consulting practice worldwide. Ralph Krichbaum, manager of technical consulting at Westinghouse/CSI Communications, provides corporate guidelines and consulting on networks and equipment. Roy Weber, director of the Systems Architecture Center at AT&T Bell Laboratories, oversees the user-interface layers of AT&T's evolving Systems Architecture.

The three were brought into dialogue by Intech, the integrated information technology conference to be held Aug. 26-29 in San Francisco. Rappaport, Krichbaum and Weber will be speaking on voice/data integration, one of five subject areas at this conference, sponsored by National Trade Productions, Inc., Suite 400, 2111 Eisenhower Ave., Alexandria, Va. 22314.

Rappaport: Integrating voice and data consists of three almost independent submarkets. I'll call them the workstation market, the office equipment market and the network market. What mix of markets a corporation decides to use is really triggered by the impetus it has in integrating voice and data.

The network market is probably the one that receives the most attention because there are tremendous savings available by



The Consultant
David Rappaport
Arthur Andersen & Co.

integrating voice and data, either by putting in tie lines, sharing Wats lines, going to full digital T1 or the like.

The office equipment market is the local-area network or private branch exchange. The impetus there is reduction in wiring costs and increased flexibility in the office.

Then, finally, there's the workstation market. Here the benefit is productivity improvements and not so much hard dollar savings. We have coming on the scene integrated voice/data workstations — personal computers with special boards in them.



The User
Ralph Krichbaum
Westinghouse

Krichbaum: I can tell you where Westinghouse has done things. In the network area, we have implemented digital facilities wherever possible. We use T1s, microwave and CATV for up to 15 miles or fiber optics where we can get it from the local telephone company.

We're also doing a lot of work in the local sites. For a number of years, we have advocated the installation of six pairs of wires from the wiring closet to each workstation when we install a new PBX. These terminate in two miniature six-pin telephone jacks, one for voice and one for data.

Rappaport: In installing your systems at Westinghouse, where were the big paybacks?

Krichbaum: The T1 between Orlando, Fla., and Pittsburgh is a case in point. It

eliminated 38 analog voice circuits, each using 32K bit/sec., and five 56K bit/sec. [AT&T Dataphone Digital Service (DDS)] circuits. The data lines cost more than \$6,000 each, and the voice circuits cost a little more than \$1,000 each. The T1 cost \$28,000 per month, and termination gear, amortized over four years,

came to another \$2,000 a month. We ended up cutting costs in half.

The big advantage of the T1s is that if you need an additional 56K bits — in our



The Vendor
Roy Weber
AT&T Bell Labs

case we're using 32K bits for voice — you get two analog private lines from the telephone company, and that's essentially your cost for 56K bits.

Rappaport: So you not only save money, but you increase your long-term flexibility?

Krichbaum: Absolutely; flexibility is key. This business is so volatile that we try to maintain as much flexibility as we can.

Rappaport: Roy, from the AT&T/Bell Laboratories perspective, where is integrated voice/data going?

IN DEPTH/INTEGRATING VOICE AND DATA

Weber: I come at it from the networking perspective. Integration of voice and data can vary all over the place. The simplest form is a point-to-point, 1.5M-bit facility with a fixed-channel assignment of circuits. Currently, 32K-bit coding of voice is an important option. Such configurations are economically attractive when you have some data circuits to go along with the voice circuits. The concept of inventorying bandwidth for flexibility and disaster recovery is also important.

One can be a lot bolder. You can certainly integrate access to a long-haul carrier service node and fan out that access to various services in a static way, a reconfigurable way and ultimately, with ISDN [Integrated Services Digital Network], in a call-by-call way. Certainly, integration goes to the terminal level as well. It

exists in pre-ISDN terminals and now with some advanced personal computer packages.

The key that everyone is searching for is the application-level integration of voice and data. Corporations shouldn't be concerned only with an individual facility or a single application. Many companies are doing the wrong thing when they build application-specific networks that turn out to be inflexible. These networks can't grow, and hence, the companies get themselves into trouble.

Integration networking is critical. The use of a 1.5M-bit backbone network with overflow to public networks, integrated operationally, makes a lot of sense.

Rappaport: Where are we in implementing that spectrum from T1s

to full ISDN? What is the time frame? And where does the small user fit in? Doesn't the small user get integrated voice/data just by sharing his Wats line in a pure dial mode?

Weber: Absolutely. Wats and 800 service are used for data as well as voice. That's integration almost at a trivial level, but it's certainly important. T1 facilities are used extensively by major customers for integrating voice and data, certainly on a fixed, point-to-point basis. One can get a 1.5M-bit access facility and then fan out the access channels to a set of special services.

In addition, with customer control and reconfiguration capabilities, one can reconfigure the resulting networks. That's being planned by people who are very interested in things like disaster recovery, where you

have a backup host computer to which you want to redirect your entire network in minutes.

This all exists today. What we're going to see is that kind of access technology being applied to the public switched services as well. In fact, it has all been developed and is in the tariff process right now. Within the next year or two, we're going to see the introduction of ISDN capabilities where you can do call-by-call assignment of channels. It's going to take awhile for that to penetrate and for people to start using ISDN protocols and the like. I think we'll see the introduction of ISDN within the next year or two, both in network and terminal-type products.

Rappaport: When we're talking about integrating voice and data, planning becomes critical. One has to take the broad view of the communications needs of the business, how we can fill those needs cost-effectively and even, to some extent, how we can use communications to give us a competitive advantage over others in our industry.

Most companies are just starting to become aware of this need for long-range planning and find they are suffering from the stumbling block of decentralized communications management, where data communications is managed in one group, voice communications is managed somewhere else and text somewhere else.

What do you see as the direction corporations should move in when they find this problem? How do we get around the organizational or political hurdle to use technology effectively?

Krichbaum: About five years ago, data communications was rolled in under corporate communications. When the Westinghouse Productivity and Quality Center was formed, the corporate telecommunications department became a part of the Corporate Systems Integration (CSI) department. As the name implies, CSI is responsible for promoting the integration of all technologies, especially electronic, as they are used in the factory and the office.

The plan that we are currently implementing — the installation of communications hubs at Westinghouse sites around the country, connected by T1 facilities to the Communications Service Center in Pittsburgh — was justified by the combined requirements of voice and data. Most of these hubs house a voice tandem switch, a corporate packet switch and data multiplexing equipment. Shared use of power transmission facilities, equipment rooms, backup power and support personnel permitted the required cost justification.

The corporate packet network permits us to combine the separate transaction networks that connect users to the computer centers supporting the many Westinghouse businesses. With small packet switches overseas and connections with the public networks, we are able to support our international users as well.

What we would like to see for local-area networking is every terminal tied into a packet assembler/disassembler (PAD). We would like to see that at 64K bits, but today those PADs aren't available. We really believe that would be an optimum network because addressing is a big

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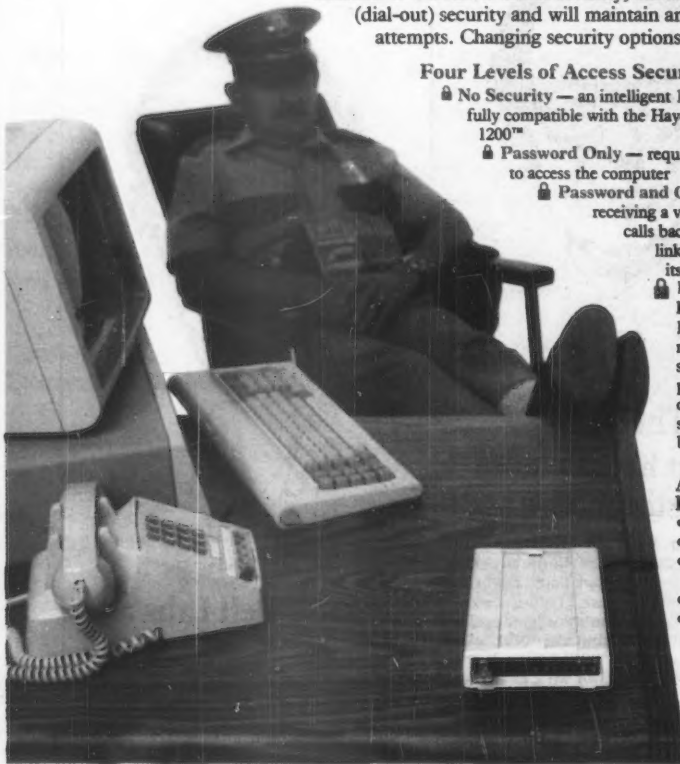
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IN DEPTH/INTEGRATING VOICE AND DATA

problem, in this corporation at least, and with a packet network, you have a built-in addressing scheme.

Weber: Packet switching is a very important technology to solve the application-specific network problem. Such networks usually consist of many multipoint private lines scattered all over the country. When the corporation tries to grow new applications, they find these networks are inflexible. Frequently we recommend packet-type technology. For intercorporate communications, packet is ideal.

Krichbaum: Another big advantage is that when you start an application, you don't have to connect it directly to a private packet network. You can use a public packet network to get to a private network.

Rappaport: Roy, what do you see the companies you deal with in the industry doing to get around the political barriers for planning and integrating voice and data?

Weber: Some are doing it effectively, and some are not. Some still play the territorial game of one person managing the computer center and another managing voice communications. They're losing out to their competitors, who have effectively gotten over that. People who have put telecommunications into the core of the company's business, as opposed to just using it as an auxiliary function, seem to do the best.

Rappaport: The ones who are successful today have attacked a business problem rather than using technology just to clean up here and there. What is the situation at Westinghouse in terms of getting over territorial problems? What plan do you have?

Krichbaum: We have the five-year strategic plan, which is to go as much as possible to digital. Early next year it's our plan to implement an essentially Class 4 office that will be ISDN-compatible. So we're looking at a central-office-type switch that will handle digital facilities in multiples of 56K or 64K bits under ISDN.

The plan is to provide dedicated circuits where we have some very high bandwidth requirements. In CAD/CAM, for example, the voluminous data that goes to the high-resolution screen doesn't lend itself too well to the packet, so we tend to do that by multiplexing.

Rappaport: What is driving this five-year communications plan at Westinghouse? Are there strategic business advantages that you see?

Krichbaum: We have a corporate electronic mail system, a voice mail system, and quite a few vendors and suppliers on that system. It really enhances our ability to communicate with our suppliers and customers. We are providing customers with a way to look at our inventories in our warehouses. We have customers that submit their orders to us by terminal. Good customers can find out for themselves when delivery could be.

Weber: That's exactly what I was talking about. That gives you an advantage over a competitor who is just trying to save costs and is not looking at those opportunities.

Corporations shouldn't be concerned only with a single facility or application. Many companies are doing the wrong thing when they build application-specific networks that turn out to be inflexible. These networks can't grow, and the companies get into trouble.

I have an example that might shed light on some of the opportunities strategically and technically. A large customer with many locations scattered through the country had a data network that was the essential to the running of its business. If there were any failures in the data network, the customer was out of business. The customer also had a significant need to manage incoming calls.

We designed for them a backbone Electronic Tandem Network (ETN) built out of 1.5M-bit transmission facilities. The voice load allowed a triangular configuration and left room for data to ride free.

The triangular design meant that every one of the hub locations had two ways to get to every other location. We therefore had a very reliable data network because of the integration with voice. Traffic from smaller locations and overflow from the large locations were served by a software defined network. We then integrated that network and the ETN operationally together.

Rappaport: As I understand it, in putting that network together, you created a PBX-based ETN with backbones using T1s. Do both voice and data flow through the PBX?

Weber: Data doesn't necessarily have to flow through the PBX. You can have a front-end system that separates the voice and data. Facility switching within the network provides an additional opportunity. We use a device called a Digital Access and Cross-Connect System to allow the customer to reconfigure its backbone network.

Rappaport: In this example, you integrate voice and data in a circuit-switched or circuit allocation style. Before, we were talking about packet switching as the optimum. How does one choose which to use?

Weber: It depends on the application. Packet switching is good for certain things, but this particular customer had a very big data need focused on a single host computer. For this customer, there were some auxiliary functions where packet switching made sense, but for the bulk of its needs, statistical multiplexing onto a reconfigurable channel network was ideal.

Rappaport: In looking at circuit switching vs. packet switching, voice drives us to channel allocation or circuit switching because we don't have packet-switched voice. Do you see a packet-switching environment whereby we would truly integrate voice and data in that type of environment?

Weber: Absolutely. We have some very aggressive exploratory work under way at Bell Labs to understand how we can become more flexible in the management of bandwidth.

That implies you have to deal with voice, because voice uses a lot of bits.

We have prototypes of packetized voice equipment; we are certainly not using traditional packet switches and X.25 protocols. We integrate data and image with the voice. That kind of thing is working in the laboratories today — in fact, there is a field trial under way where we're trying several AT&T sites together.

We're taking a careful look at how we grow the ISDN capabilities and take advantage of this technology when it's ready. While I'm not promising that the service will be introduced within the next few years, we are looking aggressively at the technology.

Krichbaum: I think you can see the pieces of that in many places. First of all, we're using four times as many bits for voice as we need because we want to handle dial-up data on the voice network. If all you're talking about is faithful reproduction of voice, 16K bits is easily attainable, and Bell Labs has had that capability for a number of years.

You mentioned before having triangular circuits so that you always have redundancy. We do that in our packet network and, to a lesser extent, in our voice network. One of the advantages of packet is that the switches and the design of the system will automatically switch if you lose a circuit. In the voice and more conventional multiplexing world, you have to do that manually. You're talking about minutes to make the backup.

Rappaport: Until now, Ralph — with your example at Westinghouse — and Roy — with the example of your client — we've been talking about the big user. How does the smaller user get started?

Weber: Smaller users who don't need or want a big backbone network still have voice and data coming out of their particular buildings. The ability to integrate access to a long-haul carrier or to a local operating company using a 1.5M-bit facility will be important to them. You can break up the access and have one of those channels access a packet service, another channel be part of the private line, another be a WATS line and another an 800 line.

If you're much smaller, then we're talking about the basic-rate ISDN rather than the primary-rate ISDN. Centrex and key system-like services, with an ISDN interface, will also be an option. There are certainly some pre-ISDN capabilities now in things like local-area data transport that the divested Bell operating companies are deploying.

Rappaport: As a prerequisite for them to take advantage of this environment, are we saying then that they need to position themselves by selecting a voice/data PBX, one of the third- or fourth-generation PBX, as a basis to get started?

Weber: That's desirable. It depends on the size of the customer.

Krichbaum: My feeling is that ISDN is going to be very viable around 1990. We're going to have a corporate ISDN before that. Today you can buy a PBX, and while it might last more than five years, you certainly shouldn't plan for a life of more than five years. Within the next couple of years, anyone who buys a PBX without vendor commitment to support the ISDN capability is backing himself into a corner.

Rappaport: Are you talking about the commitment to support the I-series international standard? Are we going to see those standards implemented in the U.S.?

Krichbaum: We're seeing the international and North American standards coming together. We still have a difference in the standards on the size of the T1. The international uses 32 channels, 30 of which are usable. In North America, you use 24 channels, 23 of which are usable. It's a world market. The need is to communicate worldwide.

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IN DEPTH/INTEGRATING VOICE AND DATA

AT&T wants to sell internationally, and the Japanese, as well as Europeans and some others, want to sell here. As a matter of fact, I think it's part of the European plan to try to implement ISDN as quickly as possible so that their local supplier can perhaps get a step up on the North American suppliers. We may see an attempt in some foreign countries to get to all-digital ISDN service as quickly as possible.

It's my opinion that we're going to see a world of communications-rich areas and communications-poor areas. I don't think we can export digital technology to those places where we can't get DDS today.

Weber: You're going to see AT&T supporting those standards both from the customer premises equipment and the network sides and in

the product side that we sell to other communications companies. That's a corporate commitment. We're very active in the international bodies that are shaping those standards. We're designing, building and defining services that make use of the ISDN standards.

Rappaport: We've talked about a lot of things in the late '80s or 1990s time frame.

Weber: I disagree. We've also talked about some here-and-now products and services.

Rappaport: Certainly the pace is picking up speed in this area. It's volatile, both from a technology and a regulatory perspective. The things people are doing today are cost driven and are therefore susceptible to

the vagaries of the tariff structure. Could we be putting in things now that we're going to be stuck with in two years and that are no longer economical?

Krichbaum: One of our axioms is that we maintain a flexible position. There are alternatives. AT&T provided T1. MCI now provides it. There's a lot of fiber optics being designed to go into the ground. It's like satellites — I don't believe it all will be put in, because there's a lot of redundancy. Satellites are a viable alternative. We would prefer to stay terrestrial because satellites have delay problems that in voice you cannot get around and in data that you can get around only with extra effort.

The digital direction is driven by the fact that the price of memory

comes down 30% a year and the price of logic comes down 25% a year. It's so inexpensive to make digital devices. The direct product cost is less than the design cost for some of the smaller vendors. We feel that the digital direction is going to take over. We believe that, standards aside, the basic environment is going to force it.

Rappaport: Are you saying you can move with changes in tariff structures and in the technology?

Krichbaum: Yes. Our basic objective is to maintain flexibility. Our long-range objective is to take advantage of the cost savings and capability offered by the new technology, and our short-range objective is to provide for the corporation's communications needs in a cost-effective manner.

Historically, we have invested in the people and tools needed to manage our networks. We have lived in a mixed-vendor environment for more than a decade.

We believe ISDN will be a fact. The desire of the communications vendors to get their users to spend more money is there. There's also the desire of the users to do things such as full-motion videoconferencing. It's a question of when, not whether.

Rappaport: So the needs are there, but we just haven't made it economical to implement?

Krichbaum: It's a chicken-and-egg situation. Packet-network PADs don't have 56K- or 64K-bit ports today. Most terminals won't communicate at 56K bits because those facilities haven't been available. But now there are PBXs at a site to permit you to communicate at that speed. It won't be too long until we'll see those speeds for IBM Personal Computers and many other devices. Transmitting at 56K bits doesn't take much more capacity than transmitting at 300 bits.

Rappaport: What about the workstation? Today we see terminals with certain telephone facilities or personal computers with telephones attached. These are made either by adding a board to a standard personal computer or by producing a new stand-alone unit. However, few applications exist to take advantage of that integration.

Krichbaum: While we plan rather far ahead, we're up to our ears trying to implement what people want today. We don't get a lot of requests for that. I'm on a number of committees where we look at those areas, but we don't see the payback; we don't see users even thinking in that direction.

Weber: There are some early forms of integrated voice/data applications, but certainly a lot more maturing is needed. Already in existence are applications such as unified messaging, where voice mail, electronic mail, station callback and message center services have integrated alerting and retrieval functions.

I see these things beginning, but clearly we have a long way to go. I believe there will be lots of integrated voice/data applications coming out of the woodwork once we have the technological foundation.

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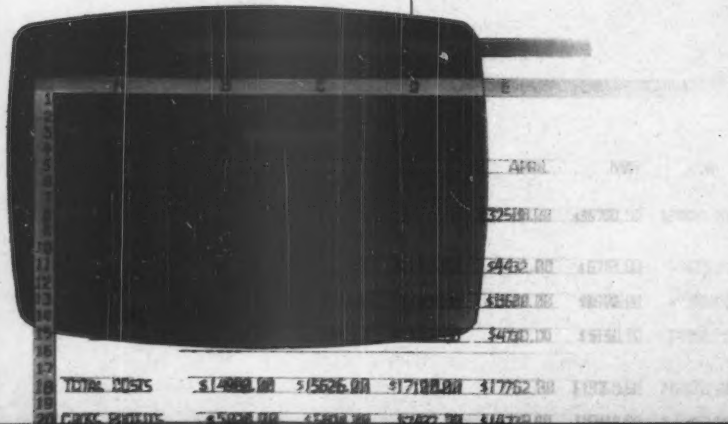
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	HONEYWELL	WANG	IBM
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• Consistent User Interface	Yes	No	No
• Integrated Word & Data Processing	Yes	VS Only	Limited
• Full Office Processing Capabilities	Yes	VS Only	Limited
• Integrated Spread Sheet	Yes	No	No
• Easy to Use Programming Tools	Yes	VS Only	No
• Query & Report Facility	Yes	VS Only	Limited
• Data Entry Facility	Yes	Limited	Yes
• User Application Interface	Yes	Limited	Yes
• X.25 Networking	Yes	VS Only	Yes
• SNA Networking	Yes	VS Only	Yes
• Exceeds ISO Networking Standards	Yes	No	No
• Electronic Mail—Peer to Peer	Yes	Limited	No

*Over 2000 installations.

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SOFTWARE & SERVICES



SOFTALK
John Gallant
CW Senior Editor

Mini software outlook mixed

Events in the microcomputer and mainframe software arenas tend to overshadow trends in mini-computer and supermini software. But, as two recent International Data Corp. (IDC) studies indicate, the minicomputer world is seeing plenty of software action. Even within IDC, however, there are contrasting viewpoints as to the future of mid-range processors — and the software that runs on them.

Recently, IDC's "Software Watch" newsletter pointed out that independent data base management system vendors are coming to see the minicomputer environment as a valuable source of revenue that has been left largely untapped. The IBM mainframe marketplace has been a hotly contested one for the DBMS makers, and observers are suggesting that, while the saturation point is still off in the distance, the IBM mainframe market has been deeply penetrated.

Thus, IDC said, some industry powerhouses have begun to port their DBMS products to the leading minis such as Digital Equipment Corp.'s VAX line or Data General Corp.'s MV 10000, both of which boast a large installed base. According to IDC, 35% of mini sites had installed a DBMS at year-end 1984. But, according to "Software Watch," that figure is deceptively high, because Hewlett-Packard Co. bundles its Image DBMS as part of its operating system. With Image sites filtered out of the sample, only 16% of mini sites had

See MINIS page 39

Girish Parikh



Published to coincide with the opening of the recent 1985 National Computer Conference (NCC) in Chicago, Girish Parikh's study titled "There is a Fortune to be Made in Software Maintenance," (Shetal Enterprises, Chicago) sheds light on what its author calls the vast opportunities awaiting exploitation in the field of software maintenance.

Parikh, a Chicago-based independent consultant and president of the research and publishing firm of Shetal Enterprises, is an author on the subject of software maintenance. Parikh spent two years researching the study, subtitled "Opportunities in the \$30 Billion Software Aftermarket," which he hopes will draw attention to the growing — and increasingly costly — problem of maintenance and the potential career and product openings that exist today.

Parikh discussed the study and maintenance issues in general with Computerworld Software and Services Editor John Gallant during NCC.

Do you think conferences like NCC devote enough attention to the subject of

software maintenance?

I am disappointed that there were very few sessions at NCC devoted to maintenance. That reflects that the industry is more concerned with front-end, or new development, projects than it is with maintenance. Maintenance is a big subject, but it is not as glamorous as development and advances in areas like artificial intelligence and microcomputers.

It is important for that perception to change. Maintenance should be seen as continuous development. There is no analogy between appliances and software. Software is an intellectual work that should grow and evolve. We need methods and standards for maintenance and a way to transfer maintenance expertise from one professional to others. Maintenance costs industry so much — billions of dollars every year — that we have to come up with these things.

What is the major finding of your study?

I found that maintenance is a wide-open area in terms of research to be undertaken. See PARIKH page 34

SOFTLINE/FRANK SWEET

Understanding flow of records key to DBMS design

Data flows through files like water through an irrigation system. In parts of a data base, records race along in a rush, while in other places they pool into reservoirs with little perceptible movement. Yet everywhere they follow a set rule: Pool time times flow rate equals population.

Records follow a steady-state law. The length of time that records spend in any section times the rate at which records flow into the section is numerically equal to the number of records currently in the section. Data base designers apply this law in all steps of their work, from initial user interviews to physical file design.

Steady-state means that the flow rate of records entering a section eventually equals the rate

at which records leave. Say that 1,000 new records are added to a file each month. The file would be in a steady state if, over a year, an average of 1,000 records were removed from the file each month. Some records might be removed soon after being added while others could stay on file forever. If more records were removed each month than were added, the file would soon disappear entirely, thus reaching a steady state with a population of zero. If the reverse were true, the file would quickly reach the capacity limit of the storage medium.

The data base should contain no unidentified data sinks or data sources. Consider a credit-checking procedure where credit applications are funneled into a department for review. If we know that their total backlog is more or less constant from year to year, we infer that just as many emerge each month as are sent in. The only way it could be otherwise would be if somewhere in the department applications were being entered into a data sink, never to be seen again, or if someone were producing new applications internally, which would constitute a data source.

Both are unlikely.

Since records out will eventually equal records in, we can use either in computing the formula — whichever is easiest to measure. A typical vendor file may receive new records whenever the firm does business with a new supplier. Inactive vendors are purged once each year. In researching the system, it may be easier to estimate the purge rate than to estimate the number of vendors added each month. And unless the firm is withering away or is in a state of uncontrolled growth, the number of inactive records purged each year will be close to the number of new records added.

The importance of the formula is that given any two of the terms, we can easily compute the third. Given all three, we can cross-check them against each other. The following problem, the case of the pending work orders, illustrates how the formula works.

As part of a materials management project, we were designing a work order reservation system. New manufacturing jobs, represented by work

See SWEET page 40

Sweet is corporate manager of data administration for the Charter Co., a Fortune 100 firm in Jacksonville, Fla. He has worked with major data base management systems since 1970 and is a former president of the national (Cullinet Software, Inc.'s) IDMS User Association.

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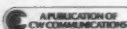
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PARIKH from page 33

en and careers to be pursued. No one has really given any attention to the problems involved or to the training that needs to be done.

As a result, we face all kinds of difficulties today. We spend at least 50% of our time on maintenance. Most programmers are not formally trained in maintenance, and our software documentation is poor.

IBM has estimated that maintenance personnel have to spend at least half of their time just trying to understand the programs before working on them.

All of that maintenance effort could be better spent on new development or other, more productive work. By training, providing better tools and streamlining the maintenance effort, we could pursue all kinds of in-

teresting projects.

But we are trying to make advances in so many fields at once that we tend to overlook maintenance. We tend to think that new technology will solve the problem, but each generation of software has its own maintenance problems.

What do you mean by the term "software aftermarket?"

That is a term I have coined to describe any work done on software, whether it is modification, correction or enhancement, after the system has gone into use. By the \$30 billion aftermarket, I am referring to James Martin's estimate of its size. I found that figure could be higher, but I went with the conservative estimate.

Are most companies sufficiently aware of the importance of maintenance?

Most managers are aware. But they don't know how to solve their problems. They don't express that because they think it will make them look bad. Thus, maintenance is often given only surface effort. But the problem won't go away until we address it and get to work on it.

Is awareness of the maintenance problem growing?

Yes. There are a lot of references to the problems in the press, and managers are increasingly aware of what needs to be done. But, as I said, the managers often don't know what to do or they don't have the resources to attack the problems.

What are the ramifications of fourth-generation languages on maintenance?

Fourth-generation languages spawn their own maintenance problems, especially if they are used to develop large programs. Even with a fourth-generation language, the programmer needs to think a system through carefully and design and document systematically. Many small programs or prototypes developed with a fourth-generation language grow into big systems. They start out small but become large applications without good design or documentation.

Is Cobol dying? What do the new Cobol 8X standards mean for maintenance?

Cobol is certainly not dying. We have billions of lines of Cobol code, and they won't soon go away. The Cobol 8X standards, because they embody modern programming techniques, will ease some of the maintenance problem... Languages are important, but good design and documentation are much more important in easing maintenance.

Are companies turning to modern programming techniques to ease maintenance work loads?

Very slowly. New ideas are not accepted quickly. If you check the personnel ads, you will see that very few companies are looking for people with structured design or modern programming skills. People are talking about the new techniques, but there aren't very many people using them or using them well.

Do you see a class of professional software maintainers arising?

Yes. Maintainers need different skills than developers, so you will see growing specialization in the future. See PARIKH page 40

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The women immediately fell into a violent quarrel, each claiming the surviving child as her own. After weeks of heated debate, the case was finally brought before King David.

"The baby is mine," wailed the first mother. "She lies," cried the second. Throwing his hands up in dismay, David dismissed the case for lack of evidence.

Enter Solomon, the King's teenage son, who had been listening from the next chamber. "Dear father," said Solomon, "give me leave to pronounce judgment between these two." Now it was known that Solomon, while young in years, was wise in the ways of people. So David consented.

"Let's chop the infant in two," said Solomon, "and give each woman a half." The first woman agreed to the division. The second, lamented. "Give her the child," she moaned, pointing to the other woman.

Solomon continued: "The child belongs to the one who weeps. She who would not see it harmed is the true mother."

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- **Generated code executable in both 24-bit and 31-bit addressing modes.** You can run compiled programs above 16 megabytes in MVS/XA.
- **Generated code identical for OS and CMS operating systems.** You can move modules between MVS and CMS without even recompiling.
- **Complete libraries.** We have implemented all the library routines described by Kernighan and Ritchie (the informal C standard), and all the library routines supported by Lattice (except operating system dependent routines), plus extensions for dealing with 370

operating environments directly. Especially significant is our byte-addressable Unix®-style I/O access method.

- **Built-in functions.** Many of the traditional string handling functions are available as built-in functions, generating in-line machine code rather than function calls. Your call to move a string can result in just one MVC instruction rather than a function call and a loop.

In addition to mainframe software development, you can also use our new cross-compiler to develop PC software on your IBM mainframe. With our cross-compiler, you can compile Lattice C programs on your mainframe and generate object code ready to download to your PC.

With the cross-compiler, we also offer PLINK86™ and PLIB86™ by Phoenix Software Associates Ltd. The Phoenix link-editor and library management facility can bind several compiled programs on the mainframe and download immediately executable modules to your PC.

Tomorrow...

We believe that the C language offers the SAS System the path to true portability and maintainability. And we believe that other companies will make similar strategic decisions about C. Already, C is taught in most college computer science curriculums, and is replacing older languages in many. And almost every computer introduced to the market now has a C compiler.

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The competition...

If you would like to compare, the other vendors of 370 C compilers are: AT&T, Whitesmiths, Ltd., WATCOM Products Inc. (CMS only), Oracle Corp., Amdahl Corp. (UTS only), and IBM Corp. (VM/IX only). We think you will choose the Lattice C compiler from SAS Institute.

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SOFTWARE & SERVICES

MINIS from page 33

installed a DBMS.

"Because it is a market-place far from maturity, [we] expect the DBMS market-place for minis to grow at much healthier rates than its mainframe counterpart. The business this year [1985] will grow some 40%," the news-letter predicted.

Another IDC study on AT&T Unix supermini implementations highlighted similar growth potential. In its report "Unix Migration Strategies of Supermini Users," IDC noted that roughly 10% of the sites surveyed are running Unix on at least one of their superminis. By the end of 1986, IDC estimated, that figure will grow to nearly 25%.

In addition, the study said that while only 25% of packaged software vendors currently offer programs running under Unix, nearly 50% of those vendors will offer Unix versions of their products by the end of this year. Not only will Unix be more widely installed in the mid-range world, IDC predicted, but a larger and more varied set of applications will be run under it.

Market heating up

It would appear from the IDC reports that the market for mini and supermini software is heating up. Vendors like DG, Wang Laboratories, Inc. and DEC are actively pursuing joint marketing and licensing deals with software vendors.

More important, it seems that software companies, many of whom have focused solely on the IBM world, are coming to recognize the extent — and potential value — of the installed base of minis.

But another messenger from IDC cast some gloom on the rosy predictions for the mini world. Commenting on the ongoing computer industry slump — which has been felt most keenly by the mini vendors — IDC Vice-President William Zachmann hypothesized that the "enormous expansion of the use of personal computers" has weakened overall demand for minis and superminis.

And, combined with micro, Zachmann said, multi-microprocessor systems will "ultimately pose a fundamental and eventually fatal challenge . . . to traditional small and mid-size systems."

Zachmann said the belief that microcomputer users' needs for access to corporate data bases or additional capacity would fuel demand for minis and larger systems is merely a myth. "The fact is that personal computers are perfectly capable of meeting many needs that would otherwise have required larger and more expensive systems," Zachmann said.

The incongruities among the IDC viewpoints seem to revolve around the fact that the Unix and DBMS studies investigated growth trends within the current installed base of minis and superminis. But Zachmann's paper pointed out what may be a longer term trend concerning the future growth of that installed base.

Zachmann's view is only one possible interpretation of the forces behind the slowdown stalling the

growth of mini and supermini vendors. But, if he is correct and if growth continues to slow, software vendors are likely to look with a jaundiced eye on product development or migration projects aimed at mid-range machines.

And, without a rich and varied supply of software, prospective minicomputer users may turn to other hardware solutions, and current users could be left in the lurch.

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SOFTWARE & SERVICES

PARIKH from page 34

Some of the job titles I have pointed out in my study include software package maintenance specialist, maintenance tools expert and maintenance analyst.

The specialization is coming, but it is important that all software professionals have at least an overview knowledge of maintenance. There are specialists in the health field, for example, but they all have a general

knowledge of medicine.

What are some common mistakes companies make regarding maintenance?

When developing systems, designers don't take the time to see potential maintenance problems. Very few managers can see two or three years down the road. Also, management usually emphasizes speed in development and maintenance. The emphasis should be equally on quality and clear documentation.

SWEET from page 33

orders, had their component requirements checked against available inventory before being issued to the shop. The idea was to avoid starting any job for which parts were missing. Instead, the job would be held while needed parts were expedited.

It was obvious that a file of pending work orders would be needed — those held awaiting parts — and that it would be necessary to know just how long to expect pending orders to stay on file. A study of the manual system found 200 work orders scattered around awaiting parts arrivals.

Although individual orders came and went, the total pending backlog had been constant at about 200 for as long as users could recall. Further, about 40 new work orders were issued to the floor each month and, on average, each waited for about 10 days for parts to arrive before being released.

Wait time?

How long will orders wait on file, on average, before the parts for each one are found?

The answer is five months, no less. Our challenge, to estimate the wait time, involved deciding whether to accept the numbers as given or to cross-check them with one another.

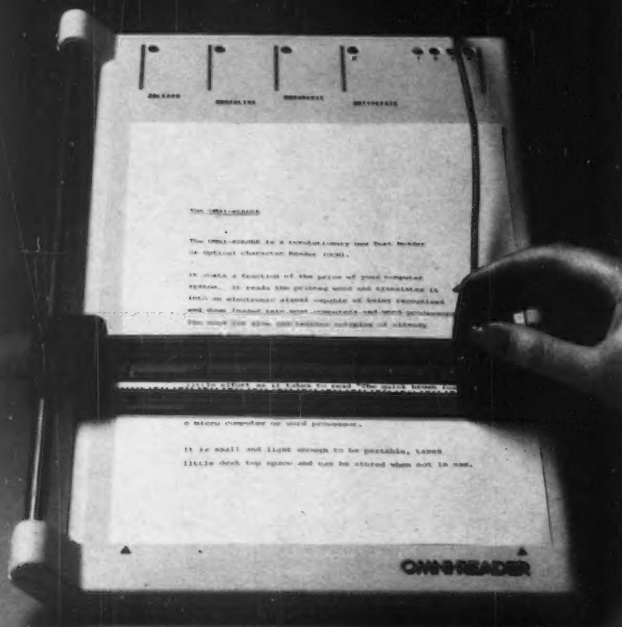
The interview-given pool time, in months (0.3), times the flow rate (40) is by no means equal to the observed population (200). The three figures we collected (flow rate, pool time, population) are contradictory. We must decide which one is wrong.

No challenge

The 200 orders sitting around were our observation, so that figure cannot be challenged. The 40 new orders per month would be easy to verify and thus were unlikely to be misstated. Besides, what motive would there be for understating the figure? It is more likely to be overstated ("See how hard we work?").

By elimination, this leaves the 10-day wait time. The number is suspect for two reasons: First, verifying it would seem impossible, so our informant could say anything at all with impunity. Second, it is the sort of thing higher management puts into goals or management objectives ("Orders must be processed within 10 days.").

When this happens, many will unconsciously adopt a convenient fiction rather than admit an unpleasant truth. Discarding the fishy 10-day figure, we compute average pool time to be population (200) divided by flow rate (40 per month), or 5 months.



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Q. IF A MODEM IS A MODEM IS A MODEM, DOES IT REALLY MAKE A DIFFERENCE WHICH ONE I BUY?

A. The fact is, all modems are not created equal. For example, some modems are better signal processors than others. And these superior modems can make an important difference in your total network performance. A difference that can lead to important savings in telecommunications costs.

Q. How can a modem make a difference in my telecommunications costs?

A. The primary purpose of a network is to move information to and from end users and thereby improve their productivity. And a superior modem can improve the performance of your network in at least four areas: It can make your network more reliable. Give your end users faster response times. Minimize the time you and your people spend on network management. And a superior modem can also save you money in line charges.

Q. What makes a superior modem?

A. As you know, a modem converts a data stream into a signal that can be sent (usually over a phone line) from Point A to Point B.

Now that may sound simple enough, but there are a number of variables in that seemingly simple scenario. Such as, what's the distance between Points A and B? What's the line between the points? What's the condition and stability of the line? And many, many more. The point is, each variable carries technical implications that affect the design of the modem. And simply stated, a superior modem enjoys a superior design.

Q. Be specific. How can a superior modem save my company money?

A. Let's face it, modems are not the most expensive part of your telecommunications network. Chances are, line charges are. If you design a modem that can send data more reliably, then that modem can begin to affect your line charges. Every time a modem has a "hit," or an unsuccessful transmission of data, the data must be retransmitted, slowing down response time. The net effect is a reduction in the amount of information carried by the network.

If you use superior modems that give fewer hits, you'll have lower line costs per data unit transmitted and better throughput. Better throughput translates into time and cost savings.

Q. Can a superior modem correct the problem of faulty lines?

A. A superior modem can go a long way toward compensating for poor line

conditions—and thus make marked improvements in the bit rate.

Take the IBM 3865 Modem, for example. It contains a custom microprocessor with an advanced algorithm that in effect enlarges the target area of acceptable transmissions. The result is that this reliable 9,600 bps modem can operate very effectively over unconditioned lines. Now imagine all the line conditioning charges you won't have to pay your common carrier.

Q. How can I go about proving the superiority of IBM modems?

A. Take your most troublesome line and put IBM modems on it. We believe you'll see an impressive improvement. Which leads us to another benefit of superior modems—you'll spend less time troubleshooting your network simply because line conditions that once were considered problems aren't really problems any more.

There are a number of other good reasons why you should consider IBM's line of 2,400, 4,800 and 9,600 bps stand-alone and rack-mounted modems. Not the least of which is that we've recently announced two new modems—the IBM 3833 and 3834—which feature lower prices, smaller packaging and improved serviceability. And like all IBM modems, they can fully utilize IBM's Communication Network Management capability.

The New IBM Modems

	IBM 3833	IBM 3834
Transmission Speed (bps)	2400 (full speed) 1200 (half speed)	4800 (full speed) 2400 (half speed)
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Communication Facilities	4-wire, point-to-point or multipoint	

Both modems operate over nonswitched telephone lines that can be leased (common carrier or FTT) or private.

*Must be in native mode. For full diagnostic capability, must be equipped with the Extended Diagnostic feature.

What's more, we've also recently lowered the prices of the IBM 3863, 3864, 3865 and 3868 Modems by as much as 29 percent. And there are also volume discounts available. If you're looking for modems that offer reliability, can improve end user productivity and are competitively priced, talk to your IBM marketing representative.

If you would like to receive a free brochure on IBM modems, call 1 800 IBM-2468, Ext. 90. Or use the coupon below. After all, it pays to be informed, because not all modems are created equal.

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MICROCOMPUTERS

Graphics-oriented Amiga debuts



Commodore's Amiga micro

NEW YORK — Commodore Business Machines, Inc. late last month took the wraps off the much-discussed Amiga, a \$1,295 machine that boasts leading-edge color graphics features and is designed for home and graphics-oriented business use.

Built around a Motorola, Inc. 68000 microprocessor and three proprietary chips that handle graphics and I/O functions, the Amiga provides a palette of 4,096 colors, available on-screen simultaneously in a "hold and modify mode," and with a maximum resolution of 640 by 400 pixels.

Scheduled to ship in September, the base system is said to include 256K bytes of internal memory — expandable to 512K bytes — and an internal 3½-in., 880K-byte floppy disk drive.

The micro also features an 89-key keyboard, parallel and serial ports, a system expansion port with full access to the

68000 bus, a mouse, two joystick ports, two stereo audio jacks and built-in text-to-voice and music synthesis capabilities, Commodore said.

The base system weighs 12½ lb and does not include a monitor. A red-green-blue (RGB) monitor is available for \$495. Three video ports are provided: analog RGB, National Television Standards Code (NTSC) for a standard TV via a radio frequency modulator and NTSC composite video. An external floppy disk drive port supports up to three additional drives, including a mix of 3½- and 5¼-in. drives, the company said.

The Amiga comes with the Amiga DOS multitasking operating system, Amiga Basic and Amiga Tutor. More than 20 software applications will be available from Commodore when the system ships, and

See **AMIGA** page 50

■ New release of Sorcim/IUS Micro Software's Supercalc3 spreadsheet package supports expanded memory capabilities/44

■ Microsoft rolled out QuickBasic Compiler for IBM Personal Computers and compatible machines/48

Nestar to unveil Plan 5000 multifunction micro server

PALO ALTO, Calif. — Nestar Systems, Inc. is scheduled today to introduce the Plan 5000, a multifunction server for the firm's microcomputer local-area networks that can be expanded to provide 1.1G bytes of disk capacity.

The server, available immediately, is aimed primarily at large corporations with existing local-area networks "[that] understand the need for the kind of storage they have on the mainframe," commented Peter Hertan, Nestar vice-president of marketing.

Depending on the application, up to 254 workstations can be supported by the Plan 5000, which typically handles 25 to 50 workstations per server, Nestar said. Multiple servers may be configured on the network.

The starting configuration of the Plan 5000, priced at \$25,000, is said to offer 275M bytes (formatted) of end-user storage capability, a 60M-byte streaming tape drive for backup, Nestar Shadow support for a secondary file server pro-

viding fault-tolerant capability, an integrated print server coprocessor that can drive three printers simultaneously and the server console.

The base system also features the Planpak starter library of network applications, including Software Connections, Inc.'s LAN:Datastore and LAN:Mail Monitor and Sorcim/IUS Micro Software's Supercalc and Superwriter packages, Hertan said.

A Plan 5000 with 550M bytes of storage costs \$35,000, a version with 825M bytes costs \$45,000 and the top-end model with 1.1G bytes costs \$55,000. A second 60M-byte tape drive costs \$2,000.

The server is compatible with Nestar's Plan 3000 and 4000, the company said. The Plan 5000 will support the IBM PC Network in two ways, Hertan said. A version of the Nestar network interface card that emulates the PC Network card is scheduled for commercial release in the fourth quarter. A network software up-

See **PLAN** page 49



MICRO BITS
Thomas Madron

Memory needs still expanding

How much memory does a micro need? As much as it can get.

From the very beginning of modern computing in the 1940s, industry observers and participants have misjudged end-users' needs and their capacity to make use of computer resources.

From the beginning of the micro revolution in the 1970s, commentators have expressed doubt that users' needs justified

See **BYTES** page 50

Madron is manager of computer services at North Texas State University, Denton, Texas.

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MICROCOMPUTERS

Supercalc3 version out

SAN JOSE, Calif. — Sorcim/IUS Micro Software has announced Release 2.1 of its Supercalc3 integrated spreadsheet for the IBM Personal Computer line. The enhanced version, priced at \$395, allows users to access memory of up to 8M bytes offered by Intel Corp.'s Above Board expanded memory capabilities.

According to the vendor, Supercalc3 2.1 also supports AST Research, Inc.'s Rampage[®] expanded memory board and IBM's Enhanced Graphics Adapter and Enhanced Color Display.

Enhanced capabilities have been added to Sorcim's Fastmath recalculation functions, which now support the Intel 8087 and 80287 math coprocessors, the vendor said.

Supercalc3 incorporates the integrated graphics, data management and macro file capabilities introduced in earlier Supercalc releases, the vendor said.

Supercalc3 requires two floppy disk drives, or a hard disk and one floppy drive, and 96K bytes of random-access memory.

The product comes with Sorcim's Sideways printing utility that can permit horizontal report printing, the vendor said.

Sorcim/IUS Micro Software is located at 2195 Fortune Drive, San Jose, Calif. 95131.

Zenith Data Systems cuts prices on line of micros

GLENVIEW, Ill. — Zenith Data Systems Corp. recently announced price reductions on its Z-158, Z-148 and Z-138 personal computers, which were scheduled to ship last month.

Suggested retail prices for the Z-158 personal computer have been adjusted from \$2,499 to \$2,199 for the single-drive 128K-byte version.

The dual-drive, 256K-byte version was reduced from \$2,899 to \$2,499, and the 10M-byte Winchester hard disk drive version has been cut from \$4,099 to \$3,699.

Pricing for the entry-level IBM-

compatible Z-148 personal computer dropped to \$1,499 from \$1,899 for the single-drive system and to \$1,799 from \$2,199 for the dual-drive version.

The Z-138 transportable personal computer with a 5¼-in. floppy disk drive was reduced to \$1,699 from \$1,999, the vendor said.

The Z-138 dual-drive model is now priced at \$1,999, down from \$2,299, Zenith Data Systems said.

Zenith Data Systems is located at 1000 Milwaukee Ave., Glenview, Ill. 60025.

Bluebird compiler allows mini applications to run on IBM micros

CARLSBAD, Calif. — Bluebird Systems announced a compiler that creates IBM Personal Computer versions of minicomputer applications.

DBComp/286 enables applications written with Bluebird's Databus programming language for Datapoint Corp. minicomputers to run on microcomputers with Bluebird's Superdos operating system, according to the vendor. The compiler converts source code directly into machine code so it

can be compiled on a microcomputer.

An IBM Personal Computer AT with Superdos reportedly can support as many as 24 users and supply up to 840M bytes of disk storage.

The compiler costs \$795 for an IBM Personal Computer or Personal Computer XT version and \$1,495 for a Personal Computer AT version.

Bluebird is located in Suite A, 6352 Corte Del Abeto, Carlsbad, Calif. 92008.

Pop-Up out for IBM line

BELLEVUE, Wash. — Bellsoft, Inc. has added Pop-Up Word to its line of background utility programs for the IBM Personal Computer line. The software functions as a full screen editor and notepad suitable for schedules, "to-do" lists and telephone lists.

Pop-Up Word includes an Ascii file editor that can be used to read and write text portions of other file formats, according to Bellsoft.

The editor works with any Ascii file, including batch and word processing files.

The package's word processing features include block operations, search, replace and delete functions. Text can be cut and pasted from the editor to an on-screen application, Bellsoft said. Lines can be inserted or deleted by a single keystroke.

Pop-Up Word accepts commands from Micropro International Corp.'s Wordstar, in addition to offering its own command set.

The package can store from 4K bytes to 23K bytes of text. Text resides in a virtual area that can be unformatted or formatted in columns, according to Bellsoft.

Pop-Up Word requires 40K bytes of random-access memory and costs \$39.95.

Bellsoft is located at 2820 Northup Way, Bellevue, Wash. 98004.



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Computerworld/Denmark serves 20,000 key EDP decision-makers throughout the Danish computer community. Each week *Computerworld/Denmark* covers new products and services, current applications and industry trends.

PC World Denmark is the monthly magazine that targets 12,000 IBM PC and compatible users and supplies them with first-hand information on the Danish PC market.

Run reaches 34,000 Commodore owners and potential owners in Denmark. Commodore is expected to grow at 40% per year through 1989. *Run* addresses the Commodore market with timely updates on hardware, software, and programs.

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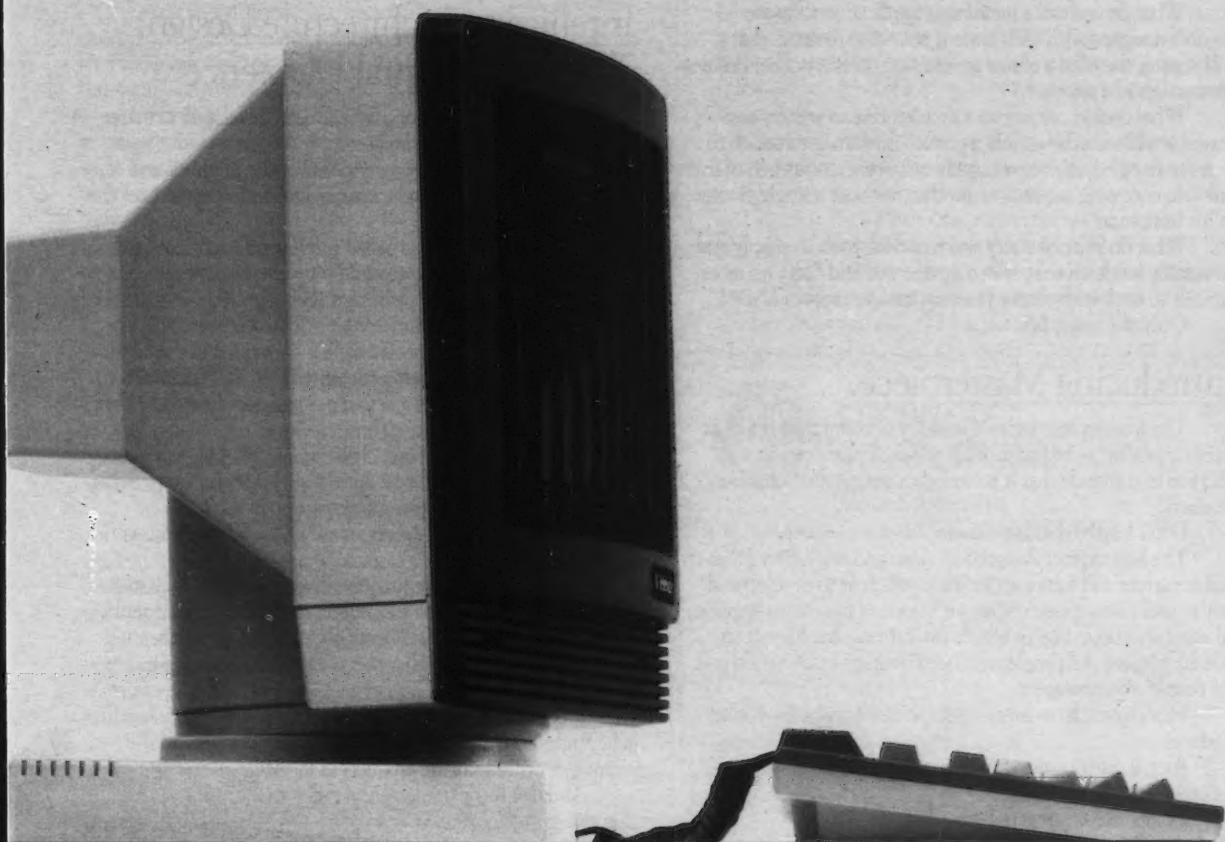
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Don't leap to that conclusion.

The Masterpiece design is so clean and uncluttered that it makes current and future applications efficient to develop and easy to use. Masterpiece comes with none of the excess baggage, inherent short-comings or system limitations that have traditionally plagued the people who need business information and the people who manage it.

Masterpiece is, in every aspect, a new family of software products.

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Previous software designs have been developed to better utilize the power of the computer.

Masterpiece was designed to mirror the methods and styles of the work place and to anticipate the *inadequacies* of the computer.

Masterpiece design is called Intelligent Architecture. It's a new term. And a new way to build software. Now, Intelligent Architecture brings new meaning to concepts like "modularity," "borderless integration" and "event-oriented processing."

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It is this capacity, present now in the Masterpiece Intelligent Architecture design, that lifts Masterpiece beyond the promise of other software products in its class.

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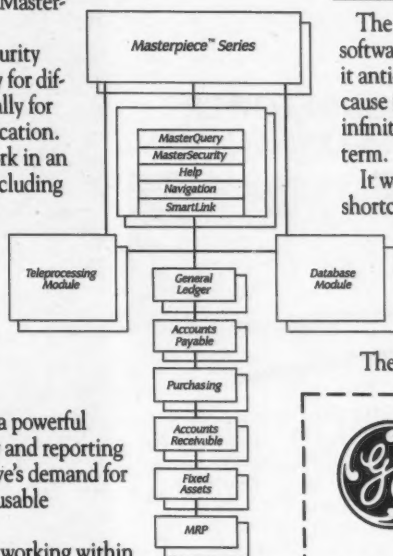
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Masterpiece

MICROCOMPUTERS

Microsoft offers compiler for micro Basic interpreters

Boasts faster execution speed

BELLEVUE, Wash. — Microsoft Corp. has introduced Microsoft Quickbasic Compiler, a \$99 Basic compiler said to be compatible with the Basic Interpreter sold with IBM Personal Computers, Compaq Computer Corp. systems and other IBM-compatible microcomputers.

Quickbasic reportedly executes at an average of three to 10 times faster than the Basic Interpreter. The software also supports structured programming features, large programs, extended MS-DOS functions, boosted graphics capability and local-area networking, the company said.

More than 3.5 million microcomputers have been shipped with some version of Microsoft Basic, and the company estimated that between 500,000 and 750,000 personal computer users write Basic programs.

"There's an immense amount of code which Quickbasic will compile," said Steven Snyder, director of language systems.

Programming features

Among the new structured programming features, Quickbasic provides alphanumeric labels and does not require line numbers, removing Basic's "single most-talked-about liability" on the IBM Personal Computer, Snyder said.

Lines are executed in the order listed, permitting Quickbasic to work with more powerful editors and making the code more readable, and users can avoid the GOTO and GOSUB commands disparaged by many programmers.

Additionally, users now can break up large programs into subprograms, which can be called by name and passed parameters (by reference or value).

Subprograms can work with either their own local variables or share global variables with the main program, according to Microsoft. Subprograms can be com-

plied separately and then linked with the main program before it is run, speeding development time, according to Snyder.

Users can create libraries of separately compiled modules, he noted. Multiline functions and standard Basic control structures also are available.

While the Basic Interpreter

requires code and data to fit within 64K bytes, Quickbasic permits data to take up to 64K bytes, with code restricted only by the amount of random-access memory (RAM) available, said Rob Dickerson, group marketing manager.

Quickbasic reportedly also supports the IBM Basic Interpreter's graphics and

sound statements, along with additional MS-DOS features including SHELL, path names and subdirectories. Additionally, hooks for MS-DOS 3.1 networking are provided, including file and record locking and file access control.

Quickbasic runs on the Personal Computer, Personal Computer XT, Personal Com-

puter AT and compatible machines. The software is scheduled to ship early this month. It requires PC-DOS or MS-DOS 2 or higher and 128K bytes of RAM (with a recommended minimum of 256K bytes).

Microsoft can be reached through Box 97200, 10700 Northup Way, Bellevue, Wash. 98009.

THE NIU-180 LOWERS COST-PER-CONNECTION.



Announcing the NIU-180: the first of an extraordinary new family of Network Interface Units that represents a direction everyone's been waiting for in local area networking. *Much higher performance. Much lower cost.*

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"This is not the way you were taught to cope with stress!"

MICROCOMPUTERS

Use of CAD tools on micros to double by 1990: report

Of CAD users, 32% run tools on micros

By Edward Warner
CW Staff

SUDBURY, Mass. — The installed base of computer-aided design software running on personal computers will double in five years, ac-

cording to a recently released report from Technology and Business Communications, Inc., a firm here that specializes in the computer graphics market. Presently, the report said, only 32% of firms that use CAD are running it on personal computers.

The report, titled "Doing CAD on a Personal Computer: A Market Study," also

predicts that in five years mechanical designers will be the primary users of CAD, taking 38% of the market, though they today claim only 24% of the market.

The use of personal computer-based CAD for electrical design makes up the largest share of the market today at 26%, but will decline to 20% of the market by the de-

cade's end, the report said.

The report, according to Technology and Business Communications President Stanley Klein, summarizes data from about 260 questionnaires returned in a mail survey of personal computer CAD vendors and from individual interviews with personal computer CAD vendors and researchers in the per-

sonal computer CAD market.

No potential personal computer CAD users, such as manufacturing or electronics firms, were surveyed, Klein said, because "users don't really assess market growth. [They] are just aware of their own growth."

Klein said his prediction of a surge in the growth of personal computer-based CAD is due to "two things: [the spread of] the distributed processing concept and the stand-alone going into places that heretofore couldn't afford such systems."

Technology and Business Communications also released recently a report that offers background on personal computer-based CAD and advice on whether new users should purchase personal computer CAD as a turnkey system or in piecemeal fashion. That report, "Doing CAD on a Personal Computer," also notes the advantages and disadvantages of using personal computer-based CAD.

Among personal computer-based CAD's advantages, the report said, are ease of use of many of the personal computer CAD programs, desktop access and generally low cost when compared with minicomputer-based CAD.

The disadvantages are said to lie in scaled-down performance. Personal computer-based CAD offers slower speeds and more limited applications than minicomputer-based CAD.

"Doing CAD on a Personal Computer" is priced at \$179. The personal computer CAD market study costs \$329.

Technology and Business Communications is located at 730 Boston Post Road, Sudbury, Mass. 01776.

THE NIU-130 LOWERS COST-PER-LOCATION.




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Net/One from Ungermann-Bass 

costs down and ere you want them.

PLAN from page 43

grade for Nestar servers, permitting networks to run either Plan or PC Network software, also will be delivered by year's end.

In addition, Herten said, Nestar expects to provide an upgrade to its networking products allowing them to work with IBM's forthcoming token-ring network within the next 12 months.

More information is available from Nestar at 2585 E. Bayshore Road, Palo Alto, Calif. 94303.



"I knew it wasn't working properly when it wouldn't work."

MICROCOMPUTERS

AMIGA from page 43

more than 75 developers are writing for the system, according to the vendor.

An optional software emulation package available in October reportedly will allow the machine to run off-the-shelf IBM Personal Computer software, although performance will not be as good as it is on the IBM machine. Additionally, an accelerator plug-in module will increase the speed of the IBM soft-

ware on the Amiga.

Each option will cost less than \$100, the company said.

Future options will reportedly include a variety of printers, a color digitizer and a genlock unit for synchronizing the Amiga with an external video device such as a laser disk or videotape player.

When these become available, developers will be able to "intertwine such standard features as four-channel audio, digitized images, anima-

tion, video synchronization and a palette of [more than] 4,000 colors," Commodore said.

Third-party options reportedly will include a 20M-byte hard disk drive, a 20M-byte tape backup, a 1M-byte multifunction card, a 2,400 bit/sec. modem and a graphics tablet.

Additional information is available from Commodore Business Machines, which is located at 1200 Wilson Drive, West Chester, Pa. 19380.

BYTES from page 43

the increases in memory from 64K bytes to 128K bytes and finally 256K bytes, offered by vendors. Next they downplayed the Intel Corp. 80286 microprocessor's ability to address 16M bytes of real storage and up to 1G byte of virtual storage.

Not surprisingly, the critics are now contending that Intel's forthcoming 80386, expected to address 4G bytes of real storage and 64T bytes

of virtual storage, represents overkill.

Few applications currently make use of the 80286's capacity to handle 16M bytes of real storage. Of course, there is no widely accepted multitasking operating system yet available for machines such as the IBM Personal Computer AT that use the 80286.

IBM's PC-DOS 3 and 3.1, which some observers once thought would have multitasking capabilities, turned out to be a single-tasking operating system.

AT&T's Unix, which might be a contender, has little end-user appeal, in part because little applications software exists to run on it, and for a business environment, Unix is so actively user-hostile as to be useless without a custom shell. Perhaps PC-DOS 4 will be a multitasking operating system.

Digital Research, Inc. offers Concurrent DOS, but because the vendor does not have the imprimatur of IBM, the product has not met great commercial success.

A multitasking operating environment could bring forth a new generation of applications for personal computers. To do the job well, however, such an operating system must run on a processor with sufficient speed and power to keep everything moving at an acceptable performance level.

As operating systems for micros become more sophisticated and complex, we can expect system overhead to continually take more space. IBM demonstrated this trend with its mainframe systems.

When the 360 series of computers was first introduced, memory of 64K bytes was not uncommon and the operating systems could run in such machines. OS/MFT actually required a bit more to leave enough for applications. The successor to OS/MFT on today's IBM mainframes, OS/MVS, requires 1M byte or more of storage but provides more services than its predecessors.

This trend is visible with microcomputer operating systems; one illustration is the difference between the memory requirements of PC-DOS and Unix.

The development of low-cost laser disk storage will likely provide the external media necessary to make use of the virtual storage capacity inherent in both the 80286 and the 80386. Low-cost read-only laser systems have already been announced for the personal computer market for introduction in mid- to late 1985.

High-cost, high-performance micros are precursors of the larger, faster machines of the near future. Those who question the need for more memory and faster processors simply don't understand modern computing.

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Quantity and quality

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to run on AT&T 3B2 and 3B5 Computers.

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UNIX System V, as well as various System V derivatives offered by AT&T licensees. So there will be an even larger, more comprehensive base of portable software from which to choose.

Our comprehensive UNIX System V Software Catalog lists a full range of packages that run under UNIX System V. For end users it's a reference guide to the programs available. And for developers it's a smart way to ensure packages will have even greater exposure to the growing UNIX System V market.

To learn more about UNIX System V market opportunities, order the UNIX System V Software Catalog—at \$19.95 plus tax. Call 1-800-432-6600 and ask for Operator 387.

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COMMUNICATIONS

Panel lauds fiber-optic net benefits

By John Dix
CW Staff

High data rates, immunity to electrical interference, low bit-error rates and small size are all factors that will fire the acceptance of fiber-optic local networks, according to a panel of experts at the National Computer Conference last month.

Obstacles to that acceptance remain, however, according to James Bryce of Netserve, an Austin, Texas, communications consulting firm. Bryce, who chaired the session called "Fiber Optics in Local-Area Networks," said it is still hard to splice and tap fibers, and further work is needed in the area of transceivers. The most dire need is for standards, Bryce said.

However, the inherent benefits of fibers shine through these present shortcomings. Although initial local network data rates

will be around 30M bit/sec., the medium has the potential to exceed 1 billion bit/sec. while sustaining bit-error rates of 10 to the negative ninth or 12th, Bryce claimed. These capabilities, coupled with fibers that are immune to electrical, magnetic and radio frequency interference, make fiber optics attractive for certain applications.

Michael See of IBM's Research Triangle Park in North Carolina, explained how fiber optics can be used in token-ring networks like the type the mainframe maker is reportedly developing. Initially, fibers will be used between distribution points, See said. Eventually, however, fiber can be extended from these hubs to workstations in a star topology. Although the network will physically resemble multiple interconnected wagon wheel hubs with spokes,

data will flow in a logical ring, running from one device back to the distribution center and to the next workstation. The wire centers enable workstation spokes or lobes to be bypassed in the event of a loop problem, See explained.

When installing fiber, it is important to ensure that the cable can accommodate future growth, See cautioned. He said the data rates of early fiber nets will be roughly 30M bit/sec., but the medium should be able to handle three generations of information processing equipment, each with a life cycle of five years.

See predicted that LEDs instead of lasers will be the primary light source for use with fibers and that the industry will standardize on the use of photo diode detectors to interpret the light signals and

See FIBER page 52

■ Datastream Communications reduced prices for its controllers by an average of 25%/52

■ Western Union announced a volume discount program/52

M/A-Com tool joins Ethernet, broadband nets

GERMANTOWN, Md. — M/A-Com, Inc.'s Telecommunications Division has announced Etherplus, a system that enables an Ethernet-type network to be implemented on a broadband network.

Etherplus is said to be compatible with Ethernet and IEEE 802.3 controllers, protocols and software. Etherplus products include transceivers for single- and dual-cable systems and head end frequency translators.

The Etherplus EP-8100 series of broadband transceivers are used on mid- or high-split single-cable broadband systems, and the EP-8200 transceivers are used with dual-cable implementations. Single-cable systems also require use of the EP-8900 frequency translator, a head end that converts signals from the transmission band to the reception band.

Both types of Etherplus broadband

transceivers replace the typical baseband Ethernet transceiver and emulate their function, although there is a delay between transmission and reception because of the inherent characteristics of broadband systems, the company reported. The Etherplus transceivers connect to IEEE 802.3-type controllers with the same multipair cable used to connect baseband transceivers.

The transceivers transmit at 10M bit/sec., with a low bit-error rate and 100% collision detection, a spokesman said. The EP-8100 and 8200 are compatible with the proposed IEEE 802.3 broadband 10M bit/sec. carrier-sense multiple access with collision detection standard.

When used with the EP-8900 frequency translator, the single-cable EP-8100 transceivers will operate over a distance greater than 3,600 meters. The dual-cable EP-

8200s boast the same capability. Any node may be up to 1,800 meters from the broadband head end.

The EP-8900 has I/O attenuators that allow adjustment of the translator gain for optimum system operation with different inbound and outbound path losses. The devices include ports for an external monitor and switch-over unit and a test port that allows direct connection of an Etherplus single-cable transceiver for operational checkout.

The EP-8900 mounts in a standard 19-in. rack with 5¼-in. panel height.

The EP-8100 costs \$3,975; the EP-8200 costs \$3,625; and the EP-8900 costs \$4,500, the vendor said. All products are available eight weeks after ordering.

M/A-Com Telecommunications Division is located at 11717 Exploration Lane, Germantown, Md. 20874.

Firm offers NCR-IBM link

System provides path to host CPU via SNA

MIAMI, Fla. — Innovative Electronics, Inc. has announced the Retail Netmaster system for interfacing NCR Corp. point-of-sale (POS) terminals to an IBM host through IBM's Systems Network Architecture (SNA).

The Netmaster system consists of the Netmaster/AP and Netmaster/IS. The Netmaster/AP is a host-resident Cobol applications program that performs configuration, control and monitoring of the network.

The Netmaster/IS is an in-store multifunction computer that supports NCR terminals and provides the interface to IBM or Amdahl Corp. SNA hosts equipped with IBM CICS/IMS software.

Network backbone

The Netmaster/IS processor allows the retailer to establish a network backbone for the authorization of credit cards and functions involv-

ing data collection.

The central Netmaster/AP and the remote Netmaster/IS together act as a real-time regulator to maintain the quality and flow of data from the in-store terminals to the host computer, the company reported.

The products are said to free the host and enable it to process individual transmissions more quickly.

Netmaster is said to carry out general merchandising functions, to eliminate the need for IBM 8270 and 721, 724 and 725 processors and to provide SNA/Synchronous Data Link Control to NCR or Burroughs Corp. Poll/Select protocol conversion.

Preprocesses POS terminal data

Netmaster is also said to preprocess POS terminal data, to reduce mainframe processing and to store remotely POS data to maintain mainframe efficiency during peak hours.

The price of the Netmaster system ranges between \$8,000 and \$10,000 for each store, according to the vendor.

Innovative Electronics, 4714 N.W. 165th St., Miami, Fla. 33014.

AT&T satellite-based data transmission service debuts

BASKING RIDGE, N.J. — AT&T recently began offering a private digital satellite service for data communications applications ranging in speed from 56K bit/sec. to multiples of 1.54M bit/sec.

Skyнет Digital Service is offered over AT&T satellites with earth stations provided through a comarketing agreement with Vitalink Communications Corp. of Mountain View, Calif.

The service will enable users to establish private digital multipoint networks using the earth stations that are installed on the customer's premises.

On a 5-year lease, these 6-meter earth stations cost \$3,810/mo for speeds ranging up to 384K bit/sec. and \$5,500/mo for stations capable of supporting speeds from 768K bit/sec. to 1.54M bit/sec.

Cost varies by speed

The space segment of the service varies in cost by speed. The monthly

costs of simplex, one-way channels are \$900 for 56K bit/sec., \$1,000 for 64K bit/sec., \$1,800 for 128K bit/sec., \$2,500 for 192K bit/sec., \$3,200 for 256K bit/sec., \$4,800 for 384K bit/sec., \$6,000 for 768K bit/sec. and \$9,000 for 1.54M bit/sec. channels.

The highest speeds are also available with a usage-sensitive billing alternative — 786K bit/sec. costs \$50 per half-hour/simplex channel, and 1.54M bit/sec. costs \$70 per half-hour/simplex channel.

Customers using Skyнет Digital Service can interconnect these private networks with AT&T's Accunet Reserved 1.5 Service.

AT&T offers this digital 1.54M bit/sec. service between 42 U.S. cities and with links to the UK, France and Canada. This would enable a location that does not have its own earth station to participate in a videoconference, AT&T said.

The service is available now.

AT&T Communications is located in Basking Ridge, N.J. 07920.

COMMUNICATIONS

Datastream slashes prices on BSC, SNA controllers

SANTA CLARA, Calif. — Datastream Communications, Inc. has reduced prices on its family of IBM-compatible Binary Synchronous Communications (BSC) and Systems Network Architecture/Synchronous Data Link Control (SNA/SDLC) 3270 controllers by an average of 25%.

The 774 line, formerly ranging in price from \$7,900 to \$15,000, will be priced from \$6,500 to \$12,900, depending on configuration. These controllers come with 128K bytes of memory and support one or two host links and up to 24 Ascii device ports.

The 776 line of BSC 3270-compat-

ible controllers, formerly priced from \$4,500 to \$7,000, are now available from \$1,950 to \$2,950, depending on configuration. The 776 line supports one BSC host link, up to nine Ascii device ports and up to 64K bytes.

The 874 line of SNA/SDLC 3270-compatible controllers, formerly ranging from \$10,950 to \$16,950, are now available from \$8,900 to \$14,400. The 874 line supports one or two SNA/SDLC host links, up to 16 Ascii ports and 512K bytes.

Datastream is located at 2520 Mission College Blvd., Santa Clara, Calif. 95050.

Western Union discounts

UPPER SADDLE RIVER, N.J. — Western Union Corp. has announced Operation Bigpipe, a volume discount program for business customers with 10 or more analog or 24 Western Union Digital Optimized Wats lines.

A typical 24-line Digital Optimized Wats service is estimated to cost 40% less than AT&T's Wats service, a spokesman said. Optimized Wats is Western Union's wide-area long-distance telephone service for nationwide calling. Rates are based on the distance of a call.

For Operation Bigpipe, customers within a half a mile from a Western Union service center will be support-

ed with local facilities procured from other carriers. On orders of 10 or more analog lines, the use of Western Union's interconnect facilities eliminate local facility charges, the company said. Customers who purchase 24, or multiples of 24, Digital Optimized Wats lines will save \$31.64/line per month in port charges.

Where Western Union has existing connections between the customer's building and the local Western Union switch location, interconnect facilities are provided free of charge.

Western Union is located at One Lake St., Upper Saddle River, N.J. 07458.

FIBER from page 51

convert them back into electricity. Although many types of fibers can be used, See recommended using fully graded 100/140 micron fibers, the first number representing the size of the fiber core and the second a measure of the fiber cladding.

Today most fibers of this type use light that has a wavelength of 850 nanometers. However, to support future generations of fiber-optic equipment, it is important to make sure the fiber being installed can support or is optimized for light with a 1,300-nanometer wavelength.

Howard Salwen, chairman of Proteon Corp., a Natick, Mass.-based manufacturer of a token-passing local network, said maintenance of fiber networks is a major concern. "Users are most interested in rapid fault isolation. Network modules should have enough intelligence to bypass faults."

Salwen said the importance of fault isolation encourages use of a ring topology with fiber nets.

Access methods

Another concern dictated by characteristics peculiar to fiber optics is the access method used, Salwen said. Although many types can be used,

the high speeds possible with fibers limit the use of methods like Ethernet-type carrier-sense multiple access with collision detection (CSMA/CD).

Token passing and CSMA/CD perform similarly at 1M to 10M bit/sec., Salwen said, but the Ethernet-type protocol collapses at 100M bit/sec., he maintained.

”

'Users are most interested in rapid fault isolation. Network modules should have enough intelligence to bypass faults.'

— Howard Salwen
Proteon Corp.

If 100M bit/sec. is not needed, a product from Secor Corp. that uses CSMA/CD may fit the bill, according to Jay Cunningham, a Secor product line manager. Secor markets a passive star coupler that acts like a hub for interconnected workstation links. Within this hub, fibers are, in essence, tied together so that a light signal enter-

ing on one fiber will exit on all the other fibers.

Wrapping up the session, Michael Coden, president of Codenoll Technology, Inc., tried to leave the audience with the conviction that fiber-optic local networks are already a reality.

Codenoll, which markets fiber nets, has reportedly sold 20,000 interface transceivers and installed a number of large nets. A former Bell operating company, for example, has reportedly installed a 2,200-node fiber net that will eventually support 5,000 nodes.

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- BIMSWAP** — Switch local 3270 BTAM terminals between multiple CICS partitions without special hardware or additional ports.
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- BIMCNSOL** — Multiple/Remote System Console function for CICS. Display-only or full input/display versions available.
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SYSTEMS & PERIPHERALS

Apollo laser printer out for Domain

BOSTON — Apollo Computer, Inc. has released a laser printer for use with its Domain workstations.

The Domain/Laser-26 prints up to 26 page/min of integrated text and graphics at a 300 dot/in. resolution, the vendor said. The printer is said to support the company's Domain local-area networking environment, and it can be configured as a shared resource anywhere on a transparent Domain network.

An integrated graphics processor contains an interpreter for Postscript from Adobe Systems, Inc. of Palo Alto, Calif. Postscript converts commands into images of text and graphics that the laser then transfers to the print engine drum.

The printer can be configured with an RS-232 serial interface or with a Centronics Data Computer Corp. parallel interface.

The Domain/Laser-26 costs \$34,900 for the Centronics parallel interface version for Multibus connection and \$31,900 for the RS-232 serial interface version. An upgrade kit to change from serial to parallel versions costs \$4,000.

Apollo is located at 330 Billerica Road, Chelmsford, Mass. 01824.

Intel ships first five IPSC processor systems

By Donna Raimondi
CW Staff

BEAVERTON, Ore. — Intel Corp. has announced that it has shipped the first five systems of its Intel Personal Super Computer (IPSC) family of concurrent processors, based on multiple Intel 80286 microprocessors.

The initial customers — MIT; Oak Ridge National Laboratories; the Research Institute for Advanced Computer Science in Moffett Field, Calif.; the Supercomputer Research Center in Lanham, Md.; and Yale University — will use the IPSC to explore applications and algorithms in concurrent processing, Intel said.

The architecture of the IPSC family is based on the hyper-cube interconnect structure developed at the California Institute of Technology. The hyper-cube consists of multiple, independent computational nodes, each with memory, linked to other nodes by dedicated communications channels.

The ability of the nodes to do their work concurrently is said to provide the processing power necessary for computationally intensive scientific applications. Very large-scale integration components are said to lower the costs of computing and to

provide familiar programming environments for researchers.

MIT plans to conduct research in numerical analysis and numerical methods, Intel said. It will use an entry-level IPSC D/5, which contains 32 computational nodes and 16M bytes of distributed memory. An MIT spokeswoman said the machine has been delivered but will not be officially accepted until a promised C compiler arrives.

Oak Ridge National Labs will use the IPSC D/5 in its mathematical and statistics research section to perform basic research for the U.S. Department of Energy.

According to Bob Ward, head of the mathematical science section at Oak Ridge, researchers there will test parallel algorithms in computational and numerical analysis such as sparse matrices and partial differential equations. Specific applications will include chemistry, solid-state physics, environmental modeling and artificial intelligence and robotics, Ward said.

The Research Institute for Advanced Computer Science will use an IPSC D/5 with 32 nodes to develop parallel programming methodologies for problems in computational fluid dynamics and computa-

See IPSC page 55

■ A disk cache subsystem for VAX users is said to cut paging time/54

■ System Industries unveiled a disk cache processor for use with all DEC VAX series machines/54

HARD TALK

Jumping into the scientific minicomputer act

By Tom Henkel
CW Senior Editor

Aside from the big slump in computer sales, 1985 may well be remembered as the year that scientific-oriented minicomputers made an indelible mark on the computer industry. Everyone seems to be getting into the scientific act, either by bolstering the number-crunching performance of commercial systems or by developing innovative architectures that some believe

will eventually replace the file-oriented von Neumann architecture that has been the mainstay of the computer industry for the past 20 years.

A major reason for users' voracious appetites for scientific-oriented systems is the increased corporate reliance on simulations and modeling, particularly at companies that design and manufacture products. The demand for computer-aided design and manufacturing systems will most likely remain brisk. But CAD/

CAM is only the beginning. The next strong market for powerful minicomputers will be for artificial intelligence applications, such as expert systems and decision support systems.

For AI applications, an emerging class of systems that use multiple microprocessors seems to show a great deal of promise. These multimicrocomputer systems typically operate either as parallel processors or concurrent parallel processes.

See SCIENCE page 54

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Oracle announces portable version of IBM SQL/DS and DB2

Any application written for IBM's SQL/DS or DB2 relational database management systems will now run without modification on DEC, DG, AT&T, HP and several other manufacturers' minis, and a wide range of micros, including the IBM PC/XT and PC/AT.

Oracle Corporation introduced the first relational DBMS in 1979. Today ORACLE is the only relational database management system that is completely compatible with IBM's SQL/DS and DB2. Programs written for SQL/DS or DB2 will run unmodified on ORACLE.

Originally designed for IBM mainframes and DEC superminis, ORACLE is now available on a wide range of machines, from mainframes to PCs. And ORACLE includes an integrated set of 4th generation software tools not available with either SQL/DS or DB2.

■ **Why not Cullinet, ADR or Focus?** There is a clearly defined standard for relational database systems. It's called SQL, and it's from IBM. Both ANSI and the US Government are in the process of adopting SQL as the standard database language. The Cullinet, ADR and FOCUS software packages each implement their own unique database language - each one painting the user into

its own corner. Since its inception, Oracle Corporation has provided total IBM SQL compatibility.

Few shops nowadays run only IBM mainframes. Why, then, even consider a database solution that runs only on IBM mainframes? Applications written with ORACLE run identically on mainframes, minis, and PCs. Because all versions of ORACLE are identical.

FOCUS, Cullinet and ADR offer either a limited subset, a completely different product or nothing at all (respectively) for the PC. And none have minicomputer products.

■ **Why not just go with DB2 or SQL/DS?** A relational DBMS simplifies but does not by itself eliminate application programming. Additional tools are necessary if users are to create and maintain their own applications.

DB2 and SQL/DS are relational systems, period. ORACLE is a relational DBMS plus integrated 4th generation software tools for application generation, report writing, color graphics and network communications.

Furthermore, SQL/DS and DB2 run only on IBM mainframes (and are somewhat unlikely ever to run on another vendor's system). ORACLE runs on more IBM hardware

and operating systems than do IBM's relational products.

■ **What about Goldengate, dBase III, Symphony or Framework?** PCs need more than PC software if they are to be usefully integrated with corporate data processing. Incompatibility with SQL, while serious, is not the only major problem with these micro packages. None provides an acceptable level of data security, integrity or recovery facilities. And their PC-to-mainframe links are functionally primitive and difficult to use.

To effectively link computers, all machines in the network should run the same software. Only ORACLE provides standard software on mainframes, minis and micros. Data and programs can then be shared among users of different machines, distributing the workload.

ORACLE is currently installed on over 1000 mainframe and supermini systems around the world, as well as on thousands of PCs. Oracle's customers include 8 out of the 10 largest U.S. corporations, as well as major foreign companies and government agencies.

For further information, contact Oracle Corp., Dept. C2, 2710 Sand Hill Rd., Menlo Park, CA 94025, or call 415/854-7350.

SYSTEMS & PERIPHERALS

SCIENCE from page 53

sors, giving users the ability to work on many different tasks at once. But the problem faced by vendors of such systems is a glaring lack of applications software specifically geared to the parallel, concurrent operating environment.

The right team

It is no secret that hardware and software are inseparable. Teaming up with the right applications software developer could easily push a vendor of a microprocessor-based system into the forefront of the emerging AI business. A mistake could be disastrous.

Intel Corp., for example, has been very careful in selecting the first users of its Intel Personal Super Computer (IPSC) hyper-cube. It has chosen well-respected universities and government institutions that it hopes will do a credible job of investigating the properties of concurrent processing.

It is also clearly Intel's hope that in the process, these institutions will develop some highly desirable software for the IPSC. In the long run, the move will probably prove to be a good one. But it also seems to fly in the face of the traditional marketing techniques used to sell new systems.

”

The next strong market for powerful minicomputers will be for artificial intelligence applications.

Intel seems to be deliberately holding back the number of IPSC systems it can deliver to users, even though Intel executives claim the demand for the system, especially among AI software developers, has been stronger than expected. The move is risky, because holding back deliveries poses the threat that the IPSC could be surpassed by a more innovative architecture from another company before it ever gets off the ground.

But at the same time, the move smacks of wisdom because a standard AI system developed around the IPSC could damage the machine's — and Intel's — reputation.

The marketing technique being employed by Intel reflects the growing complexity of software and the profound impact it can have on a new hardware product. The effectiveness of programs used to be fairly easy to verify. If the program fulfilled its intent, and did so effi-

ciently, it was probably acceptable for most applications.

Now, software not only performs a series of commands, it also analyzes data and offers users advice.

The question that requires a great deal of scrutiny is whether that analysis and advice is correct. Some software experts are now urging that giving advice be constructed in such a way that the software can also tell the user how conclusions were reached.

But even with such explanations, it is clear that artificial intelligence software will have to be closely scrutinized not only by the user who must live with his chosen package, but also by the hardware developer whose reputation as a systems supplier can be affected by the companies that develop specialized packages to run on that system.

System Industries unveils cache processor for VAX

MILPITAS, Calif. — System Industries, Inc. has launched a disk cache processor for use with all Digital Equipment Corp. VAX series superminicomputers.

The processor costs \$15,000 and was designed to cache the most frequently and most recently used blocks of data to reduce data access time.

The unit, which is driven by the Motorola Corp. 68000 microprocessor and has its own 2M-byte cache, is said to eliminate head movement for up to 95% of all disk I/O. Average access time is less than 2 msec.

According to the vendor, the VAX's primary bottleneck, especially in I/O-intensive multiuser applications, is the VAX's ability to handle heavy data loads and disk access. The disk cache processor is said to result in up to a tenfold decrease in average access time.

The disk cache processor is said to be compatible with all System Industries Winchester, removable Winchester and removable media disk drives.

More information is available from System Industries, 1855 Barber Lane, Milpitas, Calif. 95035.

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"He's a hacker all right — we brought him in to get our department some time on the mainframe."

SYSTEMS & PERIPHERALS

Intel boosts IPSC memory

BEAVERTON, Ore. — Intel Corp. has released 2M- and 4M-byte memory boards for its Intel Personal Super Computer (IPSC) family of concurrent processing systems, which are based on multiple Intel 80286 microprocessors and 80387 numeric processing units. The previous maximum memory was 512K bytes.

The memory option — which the company said can be useful in certain artificial intelligence and large-scale scientific computing applications — is said to allow an eightfold memory increase.

Intel's ILBX interface, a port on

each of the nodal processors, is used to install the memory enhancements. To add memory, alternating node boards are pulled from the ILBX interface, and the memory board is added in its place. Each of the node boards contains 5M bytes of memory.

The added memory is a field upgrade and does not add to the IPSC's price range of \$150,000 to \$520,000.

More information can be obtained from Intel at 15201 N.W. Greenbrier Pkwy., Beaverton, Ore. 97006.

IPSC from page 53

tional chemistry, said Mike Raugh, chief scientist at the center.

"We'll experiment with it and use it for learning to write parallel programs," he said. The National Aeronautics and Space Administration's Ames Research Center is sponsoring the research, he said.

The Supercomputing Research Center is said to be doing supercomputer research for national security purposes, a spokesman said. It will develop and evaluate parallel processing on the IPSC D/6.

Yale is planning research on multi-processors in order to develop algorithms that make maximum use of the architecture. It will develop new programs and languages and determine what kinds of problems can be developed with the new equipment.

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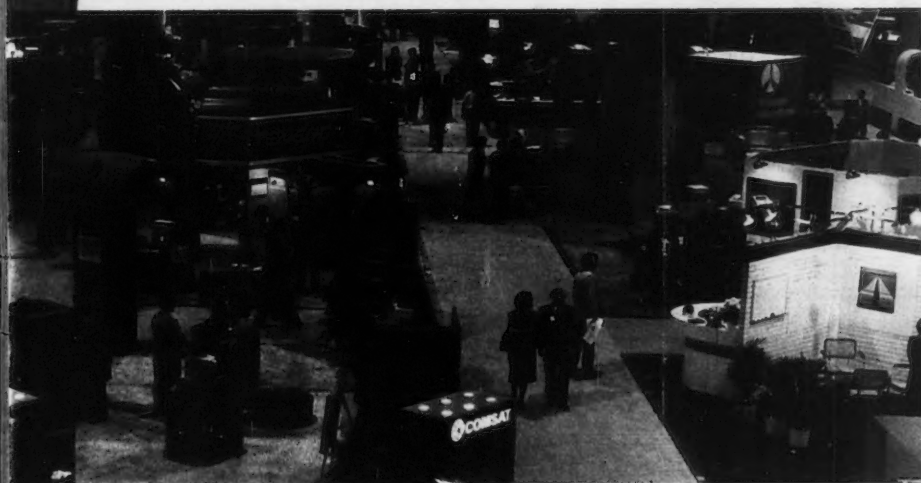
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COMPUTER INDUSTRY

Amidst shakeout, firm seeks growth via buyout

MOUNTAIN VIEW, Calif. — The much-heralded shakeout in the microcomputer software industry brings with it aggressive growth opportunities for a few companies, and Software Publishing Corp. intends to be one of the big survivors.

Last month [CW, July 8], the company announced it would acquire Harvard Software, Inc. of Littleton, Mass. The move gives the publisher of the popular PFS product series its first corporate-oriented product, Harvard's best-selling project management software, Harvard Project Manager and Harvard Total Project Manager.

In a recent interview, Fred Gibbons, president of Software Publishing, said the company must address new markets if it is to reach the \$100 million revenue mark he has targeted for 1987. Last year, the company's annual revenue was \$23 million; in the first nine months of the current fiscal year, revenue was \$26.5 million, and profits were \$4.3 million.

No further acquisitions are planned, but Gibbons did not rule out future activity. "Mergers are seductive," he said. Gibbons envisions his company in the same revenue category of mainframe software vendor Cullinet Software, Inc. within three years. "And it's all available through acquisitions like this one," he added.

But his immediate priority is "to make this acquisition work first." The merger must still be approved by the boards of directors of both companies, and neither company would comment on whether the Harvard operation would be moved to the West Coast or if its management team will remain intact. The price of the acquisition was not released, but sources said it is approximately \$7 million.

Both Gibbons and Harvard Software said they believe the merger provides each with access to the other's high-growth markets.

"We need Software Publishing just like
See BUY page 61

TI reports more losses, staff cuts

DALLAS — Continuing to feel the brunt of the semiconductor industry slump, Texas Instruments, Inc. recently announced a second-quarter loss and its third round of layoffs in eight months.

The company said its chip business operated at a loss during the quarter ended June 30. TI also reported that sales of data systems equipment declined from the year-earlier period. TI reported a net loss of \$3.9 million, or 16 cents per share, compared with year-earlier profits of \$85.9 million, or \$3.57 per share. Revenue declined 16% to \$1.23 billion, compared with \$1.46 billion a year earlier.

In a prepared statement, Chairman Mark Shepherd Jr. and President and Chief Executive Officer Jerry R. Junkins said the company plans to lay off 1,800 workers and continue reduced work sched-
See TI page 60

■ The war of words between DEC and emulator Emulex became more strident, with allegations of espionage being charged and hotly denied/58

■ No news is good news these days, with three vendors of communications products recently chiming in with less than glowing financial reports and Perkin-Elmer dismissing workers in a consolidation move/58

■ Despite the imminence of commercially viable optical storage products, Eastman Kodak is confident that demand will increase for computer-integrated microfilm applications/59

Software mart: Mixed results

As anticipated [CW, July 15], Applied Data Research, Inc. (ADR) recently reported a second-quarter loss of \$3.1 million, or 48 cents per share, its first quarterly loss in two years.

However, two other software vendors, Computer Associates International, Inc. and Computer Sciences Corp. (CSC) continued their growth, posting earnings gains for the quarter ended June 30.

ADR of Princeton, N.J., posted a slight revenue gain to \$30.1 million from \$28.5 million a year ago. But Chairman and Chief Executive Officer John R. Bennett said the increase did not keep pace with expenses. ADR had earned \$1.7 million, or 30 cents per share, in the comparable quarter last year.

See ADR page 61

Move to smaller drive not easy



INDUSTRY INSIGHT

By Edward Warner
CWI Senior Writer

In a move that holds the potential to cost users a bundle, IBM late last month announced that it has ended research and development on 5¼-in. diskette drives and plans to cease their production in its sole U.S. diskette drive manufacturing facility.

The move, according to analysts such as James Stone, vice-president for research at Shearson Lehman/American Express, Inc. in New York, is a leading indicator of Big Blue's intent to shift emphasis to the rival 3½-in. diskette format in its future personal computers,

beginning with its much-rumored laptop. For the user, this all might appear to be a small matter, something akin to a decision to offer a smaller keyboard. If only that were the case.

In actuality, users of Personal Computer software may find themselves boxed in a few years down the line as they attempt to replace their older Personal Computers with newer IBM desktop machines that use the 3½-in. drives. Confronted with the difference in size between the diskettes of their existing software and the tiny mouths of 3½-in. drives, users will try to copy their programs to blank 3½-in. diskettes.

In the case of non-copy-protected programs, like Multimate International Corp.'s Multimate word processor,
See STOP page 60

Seequa Computer ailing; others to handle production

By Clinton Wilder
CW Staff

ODENTON, Md. — One of many victims of the IBM-compatible micro shakeout, Sequa Computer Corp. now hopes to survive by having its computers built by other companies 3,000 miles away.

The 8-year-old vendor has endured reportedly massive debt, the closing of its one production facility and the layoff of almost 90% of its work force.

As recently as one year ago, Sequa employed more than 250 people, many of whom assembled machines like the IBM Portable Computer-compatible Chameleon at the production facility here. Now Sequa employs just 30 marketing, sales and management employees, and its computers

are built in California's Silicon Valley and Guadalajara, Mexico.

Late last month, a local auctioneer sold off Sequa's production plant assets in a two-day liquidation. According to Sequa officials, the firm felt it was more cost-effective to farm out all of its production to outside suppliers.

"We're looking for a new location for our offices in the near future," said Sequa sales support representative John Hughes. "There's a lot of unused space here."

In recent months, Sequa has signed agreements with three firms to handle its production. Sunnyvale, Calif.-based Televideo Systems, Inc., manufactures the portable Chameleon XL. Prime Circuit Technology builds the Chameleon in San Jose,

Calif., and the Mexican firm of Fabremex will assemble a new Sequa product in Guadalajara.

"We made the decision to shut down here six to nine months ago," said Jim Hoffman, Sequa's marketing director. "We've been gradually phasing out production, and for the last six months we've only done final assembly here. We're keeping a few production people to oversee the subcontractors, but most of [the 30 remaining employees] are in technical, sales and marketing positions."

Televideo's relationship with Sequa is tied to a \$100 million U.S. Navy computer systems contract awarded to Federal Data Corp. of Chevy Chase, Md., earlier this year. Sequa was to be a prime subcontractor for up to 1,000 Chameleons, but

the firm later sold its manufacturing rights to Televideo through Federal Data and one of Sequa's creditors, the Bank of Maryland.

"Our production costs were too high to support our manufacturing facility," Sequa's Hughes said.

Officials at closely held Sequa declined to reveal financial information, but consultant Terry Miller said the company told its creditors earlier this year that it had \$4 million to \$4.5 million in assets and \$14 million in debts. "They've been in a world of hurt," said Miller, president of Government Sales Consultants, Inc., of Annandale, Va., a firm that advises both the federal government and its computer contractors. "I think the creditors are willing to play along," Miller added.

COMPUTER INDUSTRY

Second-quarter losses hit leading vendors

The effect of the computer industry slowdown was reflected in the recently announced second-quarter financial results of three leading communications vendors. Intecom, Inc. and TIE/Communications, Inc. posted substantial losses, while Ungermann-Bass, Inc. reported an 11.5% decline in profits from the year-earlier quarter.

Shelton, Conn.-based TIE/Communications posted a loss of \$40 million, or \$1.12 per share, as second-quarter revenue of \$70.2 million was less than half of the company's revenue a year ago. In the second quarter of 1984, TIE/Communications earned \$507,000, or 2 cents per share, on sales of \$145.1 million.

TIE/Communications blamed the losses on \$40 million write-downs of the value of slow-moving inventories, \$8 million in restructuring and consolidation costs and the liquidation of some inventories. The firm's President and Chairman Thomas L. Kelly Jr. said an anticipated increase in sales and a lowered bottom line are expected to make the company profitable by the fourth quarter.

Intecom also wrote down backlogged inventories in its older S/40 and TSX product lines, a \$7.6 million charge that contributed to a second-quarter loss of \$6.8 million, or 21 cents per share. The Allen, Texas, communications switch maker earned \$1.8 million, or 6 cents per

share, in the comparable quarter a year ago. Revenue declined slightly from \$28.2 million to \$27.9 million.

Despite a 48% increase in sales, Ungermann-Bass reported an earnings decline from \$1.5 million, or 9 cents per share, a year ago to \$1.3 million, or 8 cents per share. Second-quarter revenue was \$18.6 million, up from \$12.6 million in the same quarter in 1984.

The Santa Clara, Calif., local-area network vendor reported that second-quarter operating expenses soared 62%, from \$10.9 million in 1984 to \$17.7 million in 1985. Outlays for research and development climbed 80% to \$3.3 million, or 18% of sales during the quarter.

PE cuts work force by 2%

NORWALK, Conn. — Perkin-Elmer Corp. recently announced it had reduced its work force by 240 people, or 2% of its 15,700 employees, and will shut down in early 1986 its Oak Brook, Ill., Instrument Department.

The company said the work force reduction would primarily affect Connecticut facilities and affected employees will receive full benefits for the 1985 fiscal year.

Horace G. McDonnell, chairman and chief executive officer, said the reduction followed a number of reorganization and restructuring steps made this year to strengthen the company's ability to respond to changing business needs.

McDonnell said the extent of the reduction was lessened somewhat by efforts to transfer employees to other divisions where their skills could be used.

DEC fuels Emulex suit

MAYNARD, Mass. — The ongoing legal battle between Digital Equipment Corp. and Emulex Corp. heated up recently with both firms making additional charges.

DEC amended its pending multi-million-dollar patent infringement lawsuit [CW, July 15] to charge that Emulex induced a former DEC employee to spill trade secrets, while Emulex threatened counteraction to protect itself from harassment.

In its original suit in federal court in Concord, N.H., July 5, DEC charged Emulex with using proprietary DEC technology in its DEC-compatible port protocol, bus and interconnect products. DEC added the trade secret theft charges against the firm July 22 and filed a separate trade secret theft lawsuit against former DEC senior engineer Charles Hess in federal court in Denver on July 19. Separately, DEC sought and was granted an injunction in New Hampshire on July 18 preventing Hess from participating "in any matter relating to the lawsuit."

DEC based its request on a charge that Hess, while employed by DEC in Colorado Springs, Colo., participated in a confidential meeting with attorneys discussing legal action against Emulex. DEC alleged that Hess was secretly discussing employment with Emulex at the time and "related information he learned at this meeting to Emulex." Emulex later hired Hess as director of engineering.

Emulex attorneys have 20 days to file a formal response to the July 18 injunction, but Emulex Chairman Fred B. Cox immediately issued a statement. "We believe that the primary purpose of DEC's inflammatory allegations is to strengthen its position by trying to discredit Emulex in the press," Cox said. "[The charges] that we willfully induced an employee to steal trade secrets and violate terms of an employment contract are absolutely false."



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COMPUTER INDUSTRY

Study belies 'two-tier work force'

By Mitch Betts
CW Washington Bureau

WASHINGTON, D.C. — A study said to dispute the theory that office and factory automation creates a "two-tier work force" of a small number of high-paid executives and a large number of low-paid menial workers was released recently by a computer trade association.

The Computer and Business Equipment Manufacturers Association (Cbema) said the study was commissioned to respond to critics who say that computers and robots have displaced many middle-income jobs, particularly in high-technology industries.

Statements such as these have been made by the AFL-CIO and MIT Professors Harley Shaiken and Lester Thurow.

At a press conference here, Cbema released a report by James L. Medoff, a Harvard University economist, and Paul A. Strassmann, a former MIS executive at Xerox Corp.

Medoff said his study of hourly earnings by U.S. nonagricultural workers showed that "during the past decade inequality in hourly earnings among all wage earners in this country has remained remarkably constant." This finding, Strassmann said, contradicts the two-tier work force theory.

In a previous Cbema-sponsored study done by Strassmann, he said that the computer industry "is the most middle-class industry I have found."

Cbema President Vico E. Henriques said the trade association "is pleased to help demonstrate that the fears some people have about the negative effect of computers are inconsistent with the data."

Zenith names new president

GLENVIEW, Ill. — Zenith Electronics Corp. recently announced the promotion of Robert P. Dilworth to the position of president of Zenith Data Systems Corp.

Dilworth succeeds interim President Carl A. Michelotti, who remains corporate senior vice-president and group executive with the parent company, Zenith Electronics.

Michelotti, who announced Dilworth's appointment, had served as interim president of Zenith Data Systems since May 1984.

Inteq subsidiary

Michelotti recently assumed responsibility for Zenith's recently acquired Inteq subsidiary.

Dilworth is the former president of Morrow Designs, Inc., a privately held microcomputer vendor.

Before coming to Zenith Data Systems, Dilworth was president of Ultra Magnetics and held senior positions with Varian Associates and Sperry Corp.

Exec sees growing demand for microfilm

By Peter Bartolik
CW Staff

Despite the increasing development pace of optical disk storage technology, Eastman Kodak Co. is confident that demand for computer-integrated microfilm applications will continue to grow.

During a recent interview with *Computerworld*, John A. Lacy, general manager for marketing and vice-president of Kodak's Business Imaging Systems Division, said he sees little likelihood that technological developments in magnetic and optical storage will override the cost and duplication advantages of microfilm.

"There is a tendency for people to feel that higher capacity magnetics

or optical storage is going to replace film, but we don't believe it for a second," Lacy said. During last month's National Computer Conference, Kodak's recently acquired subsidiary, Verbatim Corp., demonstrated a prototype read-write optical disk drive system using a 3½-in. format.

In recent months, Business Imaging Systems announced a number of computer-assisted microfilm retrieval and computer output microfilm imaging systems. Also, the Kodak Copy Products Division unveiled an electronic publishing system.

Lacy predicted that interest in optical storage developments will spur interest in alternative document storage technologies. He said the situa-

tion may be analogous to the introduction of magnetic disk technology, which at one time was incorrectly predicted to signal the demise of magnetic tape demand.

"We are well aware of the disadvantages of microfilm," Lacy said, noting a slower access time for retrieving microfilm. But he noted that technological developments such as the company's autoloading retrieval device has greatly improved access time. "Microfilm still is the least expensive storage medium," he said.

Kodak's strategy is to develop systems capable of using all storage alternatives and allowing customers to make their own selections, according to Lacy.



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COMPUTER INDUSTRY

STOP from page 57

that should be no problem. A Multimate spokesman said that the firm does not view such duplication as a license violation.

In the case of such software as Lotus Development Corp.'s 1-2-3 and Symphony, however, the user is in for a surprise. Both programs are copy protected and are already available in versions for the 3½-in. format.

Though there is a trend toward nonprotected software, Lotus has yet to join it, and, if it and other software vendors do not, users will find themselves compelled to buy 3½-in. versions of programs that they already own just so that they can run those programs on new Personal Computers.

Impact on 1-2-3 users

As an illustration, analyst Stone noted the impact this might have on those who want to use 1-2-3 on an IBM laptop, a machine being referred to by some as the Clamshell. As Stone put it, "my price just went up \$600 in the Clamshell to buy it in 3½-in. [drives]."

The potential cost to corporate users, who could own hundreds of copies of a copy-protected program like 1-2-3,

might be outrageous.

This is not IBM's fault; the Giant of Armonk, though much enamored of standards, has every right to move to adopt a format that uses media that is more ruggedly packaged and has the capacity to hold more data than the floppy diskette. The Personal Computer that IBM sells in Japan, in fact, uses 3½-in. drives — each holding 1M byte of data.

The software vendor, it could also be argued, has ev-

ery right to make another buck or two by selling the same program twice to users, once for the Personal Computer and again for the Personal Computer's 3½-in. diskette successor.

Additional software costs

That argument is not likely to sit well with those who are facing several thousands of dollars in additional software costs when their corporations want to upgrade their existing stock of Per-

sonal Computers.

This may be a nightmare scenario for the corporate personal computer manager, but it is not one they will likely face in the coming year unless they buy a quantity of Clamshell laptop units, should that machine debut soon.

In the view of analyst Jim Porter, president of Disk/Trend, Inc., IBM will use 1M-byte, 3½-in. diskette drives in the Clamshell, if it uses them at all next year — pro-

vided, that is, that the Clamshell is introduced.

By 1987, though, users might begin to see 2M-byte 3½-in. diskette drives in use in IBM desktop machines — and at that point, a new standard will be set. When that happens, Personal Computer software in the 5¼-in. format might become as scarce as software in the rival format is today. As Porter rhetorically asked, "You have trouble buying 78 rpm records today, don't you?"

TI from page 57

ules, primarily in semiconductor operations. "It is clear that the world semiconductor industry is in its deepest recession since 1974 and possibly the most severe in the history of the industry," the executives said.

Last December, TI dismissed 2,000 workers, and an additional 1,000 workers were dismissed in April.

The TI executives warned that conditions are not likely to improve soon. "The declining shipment trend is expected to continue, with further adverse effect on the financial performance of this business in the third quarter," the statement said.

Following the operating losses posted by Intel Corp. and Advanced Micro Devices, Inc. [CW, July 29], TI's deteriorating semiconductor operations indicate that the prolonged semiconductor slump is far from over.

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COMPUTER INDUSTRY

BUY from page 57

they need us," said Shakeel Mozaffar, vice-president of marketing at Harvard Software.

Future Computing, Inc., a market research firm in Richardson, Texas, is predicting that the market for project management software will grow from \$50 million in 1985 to \$265 million by 1990. However, most of this growth will occur in sales to smaller companies, while the

bulk of Harvard Software's present business comes from Fortune 1,000 customers, Mozaffar said.

According to Mozaffar, with its current product line, Harvard Software expects to post sales of \$6 million for the year, up from \$3.3 million in 1984.

According to Gibbons, "the Harvard product line will serve as a path to more sophisticated business applications for Software Publishing. This is the direction we

want to target, because the capabilities of personal computers are increasing, and we need to match this with more software capability and power."

More memory and windowing capabilities are the most important new developments affecting his products, Gibbons said.

Software Publishing's PFS product line has an installed base of 1.6 million units, Gibbons said. During the third quarter just ended, revenue

was \$7.8 million, up from \$5.9 million a year ago. The company posted a third-quarter profit of \$992,000, down from \$1.06 million a year earlier.

"Both partners will gain from the merger," said Paul Cabbage, an analyst with Dataquest, Inc., a market research firm in San Jose, Calif. The merger will give Software Publishing access to Harvard Software's installed base in the corporate environment, while Harvard

Software will gain financial clout and marketing expertise, Cabbage said.

But the marriage may not be completely smooth, according to one analyst. "It will be difficult for Software Publishing to create more complex programs, yet still maintain the ease-of-use reputation which is the company's hallmark," said Richard Matlack, a vice-president at Infocorp, a market research firm in Cupertino, Calif.

Software Publishing will face a horde of competitors when it targets complex applications for the corporate user, according to Matlack, who said there are more than 100 vendors producing project management packages for personal computers.

Gibbons said the company will remain basically unchanged. "We'll keep our products simple. We won't become suddenly feature crazy, adding lots of bells and whistles to our new products," he said. Since both companies sell through retail channels, the merged company will have an advantage over Harvard Software's competitors, most of which market products through OEMs, he said.

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ADR from page 57

"We have always made significant investments in maintaining, enhancing and developing new software products," Bennett said. "While we will moderate our expenses in response to what we think is a cyclical slowdown in the computer industry, we will continue our commitment to building ADR's future. Bennett predicted a \$2.1 per-share profit for ADR for the full year.

Jericho, N.Y.-based Computer Associates reported earnings increased 36% to \$1.4 million, or 13 cents per share, up from \$1 million, or 9 cents per share, in the second quarter of 1984. Sales grew 42%, from \$22 million to \$31.2 million. The results represented the firm's 15th consecutive quarter of 30% or higher growth in both sales and earnings since going public in December 1981.

"All of our operations performed essentially according to plan," said Computer Associates President Anthony W. Wang. The company also announced that the name of its recently acquired Sorcim/IUS Micro Software division has been changed to Computer Associates Micro Products Division.

CSC of El Segundo, Calif., reported more modest earnings growth of 12%, from \$4.6 million, or 34 cents per share a year ago, to \$5.2 million, or 38 cents per share, in the quarter ended June 30. Revenue increased 8% to \$187.5 million, up from \$173.9 million in the comparable 1984 quarter.

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PHILADELPHIA: Systems Personnel, Inc.
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PITTSBURGH: Mortell, Liguore & O'Brien, Inc.
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Allison Park, Pennsylvania 15101 (412) 487-5153

SAN FRANCISCO: The Computer Resources Group, Inc.
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DATA SYSTEMS DEVELOPMENT REVIEW

The Chase Manhattan Bank, one of the world's premier financial institutions, is significantly expanding the use of data processing on a world-wide basis. Our Data Systems Development Review function has a significant responsibility in this area in the USA and extending to fifty locations around the globe. We offer a wealth of unique opportunities to high calibre data processing professionals as systems review analysts.

We are currently seeking individuals
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- Three to five years data processing experience with an emphasis on the analysis and design of relatively complex systems. Experience in data processing management and/or project leadership would be very beneficial.
- Bachelors degree. MBA or MS highly desirable.
- Knowledge of state-of-the-art computer concepts and technology including data communications, data base and systems software.
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We offer an excellent salary commensurate with experience, along with liberal benefits, including tuition reimbursement. Qualified and interested individuals are urged to send resumes, including salary history and requirements, in complete confidence to: **Kathleen Kirrane, Second Vice President, General Auditing, Human Resources, Chase Manhattan Bank, One New York Plaza, 16th floor, New York, N.Y. 10081.** An Equal Opportunity Employer F/M/H

(ONLY resumes with salary history will be considered. No phone calls or agency inquiries, please.)



CHASE

DIRECTOR OF COMPUTING RESOURCE DEVELOPMENT

The Board of Regents invites applications and nominations for the position of Director of Computing Resource Development. The Massachusetts Board of Regents of Higher Education, located in Boston, is a state wide governing board with oversight responsibility for twenty-nine public college and university campuses. Including budget education, academic program review, research and planning, affirmative action, collective bargaining, a student scholarship program, and major policy development for higher education.

Applicants for the Director's position must have a Master's degree in Computer Science or related field and live to ten years of relevant programming, communications, and systems development experience. A sound knowledge of DBMS technology and strong managerial and communication skills required. Familiarity and experience with Cyber and/or IBM mainframes, minicomputers and local area networks is desirable.

Major responsibilities include assistance in the development of long range plans for system-wide computing and responsibility for working with campuses and other state agencies on various joint hardware and software acquisition plans. The Director will serve as the primary liaison for technical assistance to campuses on systems' issues and problems. Salary range from \$38,000 - \$47,000.

Applications and nominations, including current resume and list of references, should be received no later than August 30, 1985. Minorities and women are encouraged to apply.

Address applications and nominations to:

The Search and Screen Committee
C/O Vice Chancellor for Management
Systems and Telecommunications
Massachusetts Board of Regents
of Higher Education
Room 619, McCormack Building
One Ashburton Place
Boston, Massachusetts 02108-1535

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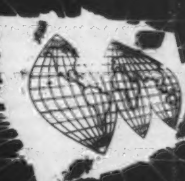
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SAUDI ARABIA DP CAREER OPPORTUNITIES

The Computer Department at the Ministry of Planning is seeking highly motivated individuals to play a major role in the definition, design, programming and implementation of business, planning and socio-economic systems.

The Ministry of Planning of the Kingdom of Saudi Arabia is responsible for the preparation of the national 5-year development plans and the monitoring of their implementations.

The mandate of the Computer Department in the Ministry of Planning is to provide computer support to its different departments by developing necessary models and systems, and maintaining existing ones.

These systems are being developed on an IBM 4341 VSAM/TSO/ISPF using mainly ADABAS/NATURAL but also COBOL, FORTRAN and SAS.

A number of immediate opportunities are available for DP professionals in the following areas:

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MS required in Computer Engineering or Computer Science or equivalent. At least 8 years experience in Data Processing out of which at least 4 years must be in managing and implementing office automation technology. Must have the experience of using the microcomputer software (DBASE II, WP, Spread-sheet etc.). Ideal candidate will also be familiar with the Arabic language business systems and development software. Interpersonal skills and ability to train users.

SYSTEMS ANALYSTS

BS/BA required as a minimum. Must have at least six years experience in DP and a proven track in the following areas: Requirement analysis, project responsibilities from inception through completion, excellent written and verbal communication skills, familiarity with conventional languages, hands-on experience in ISPF, knowledge of data base concepts, experience in using systems development methodologies and in preparing documentation for all phases of the systems development life cycle, experience in statistical modelling is a plus.

PROGRAMMER/ANALYSTS

BS/BA required in CS or related discipline, must have at least four years experience analyzing, designing, programming, testing and maintaining business application systems on IBM mainframe, good knowledge of COBOL and/or PL/I essential, familiarity with FORTRAN and NATURAL is a plus, good communication skills. Familiar with systems development methodologies and documentation of application systems.

COMPUTER PROGRAMMERS

BS/BA or equivalent diploma required. Must have at least three years experience in preparing program design and specifications, programming and testing business application systems on IBM mainframe, experience in using different access methods including VSAM and data base management systems, good communication skills.

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Computer Department, Ministry of Planning
P.O. Box 358
Riyadh 11411, Kingdom of Saudi Arabia
Telephone: (966) 01-401-0280
Telex: 202075 PLAN SJ

Last date for submission of applications is September 4, 1985.

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Inviting resumes from individuals in the more highly technical computer related specialties such as: IBM/PC Computer Scientists, Operating System Developers, Data Base Developers, Printing Specialists, Network and Telecommunications, Architecture, Artificial Intelligence, Graphics Systems Developers, Microcoders and Firmware Developers, Compiler Development, etc. Special interest in emerging technology such as novel architecture, UNIX, ADA, etc. Strong interest in scientific applications developers including military, process control, data acquisition, telemetry and communications, CAD/CAM, simulation and modeling, etc.—we are a professional employment firm managed by graduate engineers. Fees are paid by the employer. All geographic locations. Send resume or call D.A. Redwine and ask for our free resume workbook & career plan.

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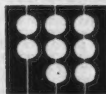
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DIVISION OF UNIVERSITY COMPUTING
ACADEMIC COMPUTING SPECIALIST III

Assists faculty and students using statistical software on the academic mainframe (IBM 3033 MVS/TSO). Duties include consulting, teaching short courses, writing documentation. Requires BS and 3 years experience. Prefer experience with SAS, SPSS, graphics, and simulation software.

ACADEMIC COMPUTING SPECIALIST II

Assists faculty and students in the use of the academic minicomputers (VAX 11/750 VMS). Duties include consulting, teaching short courses, writing documentation, and assisting with system management and systems programming. Requires BS, 2 years experience, and knowledge of 2 languages (PASCAL, BASIC, or FORTRAN).

INFORMATION CENTER SPECIALIST

Assists faculty and staff using applications on the administrative mainframe (IBM 3083 MVS/TSO). Duties include training users, writing documentation, and assisting users in developing their own application. Requires BS and 3 years experience. Prefer experience with EASYREVE, CICS, CINCOM's TIS products, and SAS.

PROGRAMMER III

Supports the computer resource utilization and chargeback software. Duties include producing reports, consulting with users, and providing training and documentation. Requires BS, 1 year of experience, and knowledge of COBOL. Prefer experience with KOMAND, SMF file, IBM Assembler, and SAS.

PROGRAMMER II

Develops student information applications. Requires BS in computer related field and knowledge of COBOL. Prefer 1 year experience and knowledge of EASYREVE, CICS, and MVS/TIS.

Auburn University is a state-supported land grant university with a broad base of programs in the liberal arts, sciences, and professional areas, and a strong commitment to graduate education and research. The main campus has nearly 19,000 students enrolled and is located near the eastern border of Alabama just over 100 miles from Atlanta, Georgia.

The closing date for all applications is August 26, 1985. Send a letter indicating the positions applied for, a current resume, and the names, addresses, and phone numbers of 3 references to:

Personnel Selection Committee
Division of University Computing
144 Parker Hall
Auburn University, AL 36849

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- Analysis programming for conversions of all IBM systems to upgrade facilities. Redesign Management Info Systems & maintain same on IBM mainframes utilizing: COBOL, PL/I, DOS, OS/MVS, CICS, IMS, 3 yrs experience or 3 yrs related programming exp. 2 yrs data processing studies. \$35,000/yr to work 35 hrs/5 days/wk. CAP Gemini DASD, Edison, NJ job location, send resume to Box # CW-84673, Computerworld, Box 880, Framingham, MA 01701.

PROGRAMMER, BUSINESS

Research, design and development of software with working knowledge of systems programming and data base design for the purpose of obtaining optimum efficiency in use of computers. (Honeywell level 6) and 6. Languages: PL/I, PICK BASIC, B.A. in Computer Science required plus 6 months experience. 35 hours per week. \$22,000 per annum. Job Order #NY 012078. D.O.T. Code: 020 162 014.

Mail resume to:
NYS Job Service #04 NY8012078
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Openings at all levels in any of the above. Call Maggie Lipitz, 213-670039 or submit resume to Interface Inc. 17 West 54 St, NY, NY 10019.

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In return for your qualifications, Hughes offers a competitive salary and an outstanding benefits package that includes medical, dental, and vision-care coverage for you and your eligible dependents. We also provide our employees with a tax-deferred savings plan.

Please send your resume to: Dr. Thomas H. Athey, Assistant Director System Planning, Hughes Aircraft Company, Corporate Communications & Data Processing, P.O. Box 9399, Bldg. C5, M/S 2009, Long Beach, CA 90810-0465. U.S. Citizenship Required. Equal Opportunity Employer

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We are a well respected consulting group with about 300 employees. For the past 13 years, we have been providing a wide variety of services in the fields of management, organization and data processing on behalf of important clients in West-Germany, Italy, Spain and abroad. Within the field of EDP, especially system consultancy, we are among the leading companies in Europe. We are now considerably expanding our Systems Consulting Section and are therefore looking for several new members of staff.

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Position requires a Bachelor's degree in Computer Science, Quantitative Systems or related field or equivalent experience; 1-3 years experience in programming and systems software programming, MVS and VM and at least 2 years experience in computer operations highly desirable, along with DOS and systems design.

Interested and qualified candidates should submit resume by August 16 to: CITY OF MESA, Personnel Department, P.O. Box 1466, Mesa, Arizona 85201-0904. For More Job Information Call (602) 834-2365.

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DIRECTOR OF COMPUTER SERVICES

The Evergreen State College invites applications for the position of Director of Computer Services. The Director is responsible for planning, developing and managing computer services and resources in an innovative, state-supported, four-year liberal arts college. The Director works with faculty to ensure support for the diverse application of computing resources throughout the curriculum. SALARY: Negotiable. APPLICATIONS: Submit (1) a resume detailing education and work background; (2) a statement of qualifications for the position; (3) names, addresses, and telephone numbers of three references who can evaluate both experience and management style. MAIL TO: The Evergreen State College, Employee Relations Office, Search Committee, Computer Director, Olympia, WA 98505. Review of applications will begin on September 16, 1985. All of the material must have been received before an applicant can be considered for the position. Call (206) 866-6000 ext. 6361 for information. An Equal Opportunity, Affirmative Action Employer

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Compensation includes salary of \$30,430 and 50% employer contribution to health and life insurance package. No training is available from employer; the applicant must be fully qualified as described above.

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General knowledge of systems analysis and a strong working knowledge of programming; ability to independently test and debug programs and prepare documentation; to translate detailed logic flow descriptions into coded computer program instructions; to modify existing programs to accommodate changes in system requirements for equipment configurations; to design detailed record and form layouts; to prepare comprehensive computer functional descriptions; and to communicate well verbally and in writing.

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Knowledge of applications analysis and programming; methods to utilize languages, hardware and tools in developing, coding and implementing applications; ability to work with client personnel to determine solutions and type of data to be processed; to analyze solutions in terms of operating system requirements and modify design to get maximum advantage of existing equipment; to establish efficient and effective procedures in support of automated systems; to work under limited supervision; to write, test and maintain computer programs; to devise data verification methods and standard system operational procedures; to prepare problem definitions and recommendations of equipment needed; to prepare detailed logic flows and machine instructions; and to communicate verbally and in writing.

Send application material to:

Statewide Office of Human Resource Development
University of Alaska
Room 1, Bursall Building
Fairbanks, Alaska 99701

Closing date: August 18, 1985

Your application for employment with the University of Alaska may be subject to public disclosure if you are selected as a finalist for the position. The University of Alaska is an AA/EEO employer and education institution.



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Senior Programmer

The University of California, Los Angeles, has an immediate opening for a Senior Programmer in its Laboratory of Nuclear Medicine. Will work in the research area of positron emission tomography. Primary duties include systems design, system and application programming, documentation, maintenance, consultation and training for all projects involving positron emission tomography. Position requires: education and experience equivalent to a Bachelor of Science degree in Computer Science, Electrical Engineering or equivalent and four years of computer programming experience including one year of programming experience related to positron emission tomography. Masters degree in a related field preferred. Also required is a detailed knowledge of: PDP 11 and RSX 11M computers, FORTRAN, RAIFOR and PDP 11 macro assembly language and positron emission tomography; demonstrated skill in working with E58G Ortec positron tomographs. Salary range is \$2603, to \$3791 per month. Please send resume to: University of California, Los Angeles, Laboratory of Biomedical & Environmental Sciences, Laboratory Personnel Officer — MR, JOB #R-2684, 900 Veteran Avenue, Los Angeles, CA 90024. An Affirmative Action Employer.

UCLA

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CW-S-JP-0805

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4331-1	0.25	0.5 to 1		3083E	4.5	8 to 32
4331-11	0.38	1 to 2		3033N	4.5	8 to 16
4331-2	0.50	1 to 4		3033EX	4.4	8 to 32
4341-9	0.52	1 to 4		3033UP	4.0	4 to 24
4351-3	0.70	2 to 4		3033	4.0	8 to 32
4341-10	0.75	2 to 4		3033EX	6.0	8 to 32
4341-1	0.88	2 to 4		3033	8.4	8 to 32
4341-11	1.1	2 to 8		3033AP	8.5	16 to 32
4361-4	1.15	2 to 12		3033AP	8.5	4 to 24
3031	1.2	2 to 8		3033	9.8	8 to 32
4361-5	1.45	2 to 12		3033	10.8	16 to 32
4341-2	1.5	2 to 16		3033	11.5	16 to 48
4341-12	1.65	2 to 16		3033	11.5	16 to 64
3033AP	2.0	2 to 8		3033	14.0	16 to 48
4381-1	2.1	4 to 16		3033	15.5	16 to 64
3032	2.5	2 to 8		3033	26.5	32 to 96
4381-2	2.7	4 to 32		3033	28.7	32 to 128
3033S	2.9	4 to 16		3033	29.4	64 to 192
3033CX	3.3	8 to 32		3033	52.9	128 to 384

*First installation 1984 *First installation 1987

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470V/9	6.5	8 to 32	AS-9063	8.4	16 to 32
5840	9.8	8 to 64	AS-9040	7.2	8 to 48
5850	11.8	16 to 64	AS-9050	9	8 to 48
5860	14.8	16 to 64	AS-9060	11.2	16 to 64
5870	22.0	24 to 64	AS-9070	16.2	16 to 64
5880	32.0	32 to 128	AS-9080	20	16 to 64
5870	26.6	16 to 64	1AS-XL-60	28	32 to 256
5880	26.6	32 to 128	1AS-XL-90	30	64 to 256

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The above information is intended as a guideline for computer users on relative computer system instruction cycle times. All data have been derived from published documentation and represent reasonable estimates of average MIPS ratings. However, Randolph is

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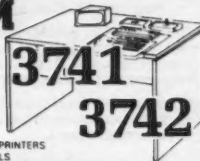
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